NGA-LTER

Northern Gulf of Alaska Long-Term Ecological Research

Cruise Report April/May 2019

Cruise ID: TxS19 (TGXS19)

Funding Sources: NSF, NPRB, AOOS, EVOS/GWA

Purpose:

The NGA is a highly productive subarctic Pacific marine biome where intense environmental variability has profound impacts on lower trophic level organisms and community dynamics that, directly or indirectly, support the iconic fish, crabs, seabirds and marine mammals of Alaska. In the NGA, a pronounced spring bloom and regions of sustained summer production support a stable base of energy-rich zooplankton grazers that efficiently transfers primary production up the food chain and a substantial sinking flux of organic matter that exports carbon to the sea bottom communities. The LTER research cruises examine features, mechanisms and processes that drive this productivity and system-wide resilience to understand how short- and long-term climate variability propagates through the environment to influence organisms.

This cruise represents a continuation of sampling begun in fall 1997 under the NSF/NOAA NE Pacific GLOBEC program, and subsequently a consortium of the North Pacific Research Board (NPRB), the Alaska Ocean Observing System (AOOS), and the Exxon Valdez Oil Spill Trustee Council's (EVOSTC) Gulf Watch. This is the second year with expanded domain, measurements and investigators under the NSF's Northern Gulf of Alaska Long-term Ecological Program (NGA-LTER). This cruise marks the 22nd consecutive spring cruise for the Seward Line in the NGA, including Prince William Sound (PWS), and the 49th year of observations at GAK1.

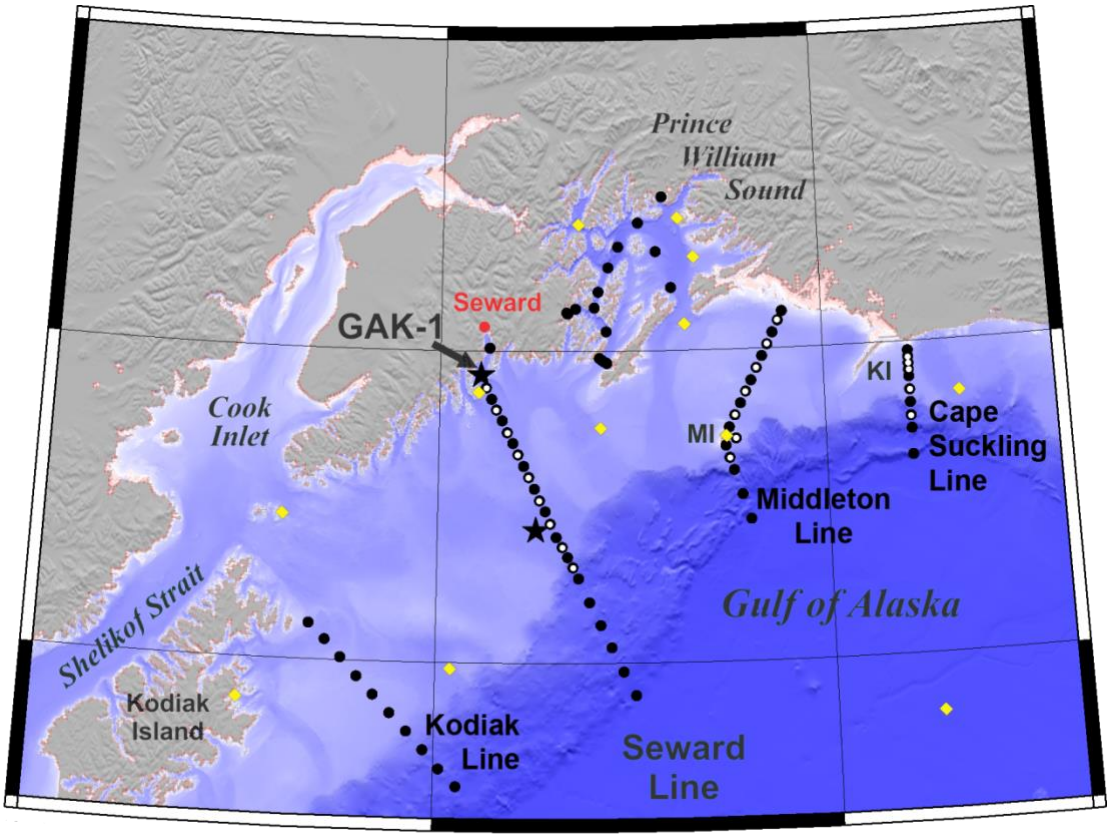

Figure 1. The LTER sampling stations. CTD casts without water sampling as open symbols. Yellow diamonds represent locations of meteorological data from NOAA buoys or ground stations. The Cape Suckling line was not sampled.

Daily summary

April 25th - Day 0 – Science team arrived in Seward and organized equipment in warehouse – much of evening was spent preparing the CTD with a new extension stand.

April 26th – Day 1. Began at breakfast unloading the U-Haul onto the ship and started installing the new meteorological package. Major equipment from warehouse was not fully loaded before the ship needed to move to the railway dock at ~8:30 to load the largest items (TM Conex, CTD winch). Tiglax returned from the Railway dock ~10:30 to complete loading of science equipment. Aside from general setup, time was spent trying to resolve a problem in wiring of Conex to ship (ground fault issues still remained). The ship's TSG had failed, so installing a backup TSG of a different model delayed departure until 22:00. A CTD cast at Res2.5 commenced at 22:45, and a bottleless cast at GAK1 was conducted at 0:35. We then transited toward MID5 (there was no night work).

April 27th – Day 2. The morning was spent in transit and completing setup. The delayed departure meant the best case for reaching our process station would be shortly after noon and would result in unsatisfactory positioning and logistics for the remainder of the Middleton Line. The decision was made to begin with night work, so we made a shore trip to Middleton Island during the afternoon. We began night work (Bongos) at MID6 at 22:00 and worked inshore to MID2 ending at ~4:30.

April 28th – Day 3. Day Work began at ~8:00 with a CTD cast at MID1 – due to the shallow depth (15m) Calvets nets were not conducted at MID1. The IronFish was deployed. Intensive Station MID2 began with a production CTD cast at 10:00. The full suite of sampling was completed by 11:30, with activities slowed by the pumping rates associated with DIC sampling from Niskins. We worked outward through to MID6i, ending daytime activities by 21:00. Night activities began at MID7 at 21:45, with seas having built over the late afternoon. Bongos were completed at Stations MID7, MID7i (by mistake) and MID8, before sampling activities were shut down by high seas with winds gusting to 35 kts. We sought shelter to the east of Middleton Island.

April 29th – Day 4. With winds not expected to abate until the following morning, we made the decision to head into PWS, pulling anchor at 8:30. We completed the CTD section at Montague Strait between 16:00-18:00, with bottle and net sampling only undertaken at MS2. A CTD cast was undertaken at KIP0 on route to KIP2. Night work began at 21:30 at KIP2 and worked north to PWSA ending at 04:00.

April 30th – Day 5. Day work began early at 6:00 with a CTD and Calvet at PWSA. The IronFish was deployed. Sampling proceeded southward, completing PWS3 then onto Intensive Station PWS2. The productivity cast began at 10:00, followed by 2 Calvets, a regular CTD, and both a deep and shallow vertical multinet that were completed by 14:15. We continued to move southward occupying PWS1 and KIP2 before heading to IB2, IB1 and, surprisingly, even IBO due to limited ice-cover. Sampling at IB0 was conducted while some of the science team conducted a small-boat trip to near Chenega Glacier's face. We left Icy Bay at 21:30 and headed to GAK1. Night work conducted a Bongo and Towed Multinet at GAK1 then helped set up for Day Sampling.

May 1st – Day 6. Day work began at 6:30 at Intensive Station GAK1 with a vertical Multinet, followed by 3 CTD casts and 2 Calvets. The IronFish was deployed. Sampling continued southward along the Seward Line, finishing GAK4i at 17:30. While positioning for starting night-work at GAK2, Bongo nets were completed for NOAA at GAK3 and GAK2. Night sampling at GAK2 began at 21:30 with Multinets, and headed southward completing GAK6 at 05:00, then conducted Bongo nets at GAK6 and GAK5 while repositioning for day-work.

May 2nd – Day 7. Day-work began at 07:30 with a vertical multinet at Intensive Station GAK5, followed by a regular CTD, 2 Calvets and a Productivity cast that ended at ~10:00. The IronFish was deployed. We worked southward along the line ending at GAK8i at 17:15. We transited out to GAK9 where the night team began Bongo nets and worked bongos northward to GAK7, where they switched over to Multinets at dusk (~22:00) to sample heading southward to GAK10, where operations were shut down by weather at 04:20 after Multinet retrieval. The ship held station for the remainder of the night.

May 3rd – Day 8. We spent the day holding station waiting for the weather to pass. Just after midnight seas had improved enough that we could conduct a Multinet at GAK11 and Bongos at GAK11 and GAK10, then reposition to GAK9.

May 4th – Day 9. Day-work began with Intensive Station GAK9 with a vertical Multinet beginning at 07:30, followed by the regular CTD, 2 Calvets, and the Prod CTD. The IronFish was deployed and we began heading south along the line. With bad weather coming, we worked as far as GAK15, completing the CTD there at 23:15. Night work deployed the Multinet at 23:40 and worked Multinets northward to GAK12, then switched back to Bongo nets at ~5:00 and headed south completing the last Bongo at GAK15 at ~10:00.

May 5th – Day 10. Day-work began at Intensive Station GAK15 with a prod CTD at 10:20, followed by deep and shallow Multinets plus 2 Calvets as winds continued to build. Station work was completed by 13:30, then the IronFish was deployed for some additional collections as we began transiting to KOD7. Nightwork began at midnight, with Bongo nets deployed from KOD7 to KOD12 that ended at 7:00.

May 6th – Day 11. Day-work began at 7:40 in the middle of an Eddy at KOD12 with a CTD and Calvet, followed by the same at KOD11. We began Intensive Station KOD10 at Noon with a prod cast, followed by 2 Calvets and a regular CTD that were completed by 13:45. The IronFish was deployed. We proceeded sampling northward, ending at KOD6 at 21:00. With more weather coming, night-work began immediately with at Bongo net at 21:20 and proceeded to work Bongo nets northward as far at KOD1 at 03:40 as weather degraded.

May 7th – Day 12. We spent the day in Kodiak Harbor while a gale moved past the island. We got underway at 0200 positioning ourselves for KOD1.

May 8th – Day 13. Day-work began at 06:00 at KOD1 with a CTD and Calvet then we worked southward reaching Intensive Station KOD5 at noon. Sampling at KOD5 began with a Prod cast , followed by 2 Calvets and the regular CTD that ended at 13:00. The IronFish was deployed. We continued south to KOD6 to complete the transit for bird and mammal observations, then began the transit back to Seward at ~14:00. Partial pack-up was completed while in transit. A bottleless CTD and Calvet were completed while passing GAK1 at 04:00,

May 9th – Day 14. We began offloading equipment at 07:00, and headed back up to Fairbanks and Anchorage by midday.

General Comment: *the weather this cruise was challenging in that several storms came though pushing us off sampling lines. PWS was reduced to one day to ensure shelf lines would be completed.*

Physics Report:

PI: Seth Danielson, Participant: Jordi Maisch

On this cruise we conducted 72 casts for water column hydrography at 62 stations (Fig, 1,2) using a 15 x 6 liter bottle rosette. Bottle trips were made at standard levels: 0, 10, 20, 30, 40, 50, 75, 100, 125, 150, 200, 250, 500, 750, and 1000 m depths and within 5 m of the bottom when the bottom depth was less than 1000 m. The SBE9-11 CTD was outfitted with pressure, dual temperature, dual conductivity and dual oxygen sensors. Ancillary sensors included a WetLabs fluorometer, a WetLabs C-Star transmissometer, a Biospherical PAR sensor, a SUNA nitrate sensor (not yet calibrated) and a Benthos altimeter. One channel was assigned to a self-logging Sequoia LISST particle size spectra instrument. A self-logging Underwater Vision Profiler (UVP) was also attached to the CTD rosette frame. The UVP instrument required a 30 meter soak depth.

The CTD stations were occupied on three shelf transects (Kodiak, Middleton, and Seward Line; Fig. 3-5) plus stations in Prince William Sound, including stations across Montague Strait, and one fjord (Icy Bay), and along Knight Island Passage.

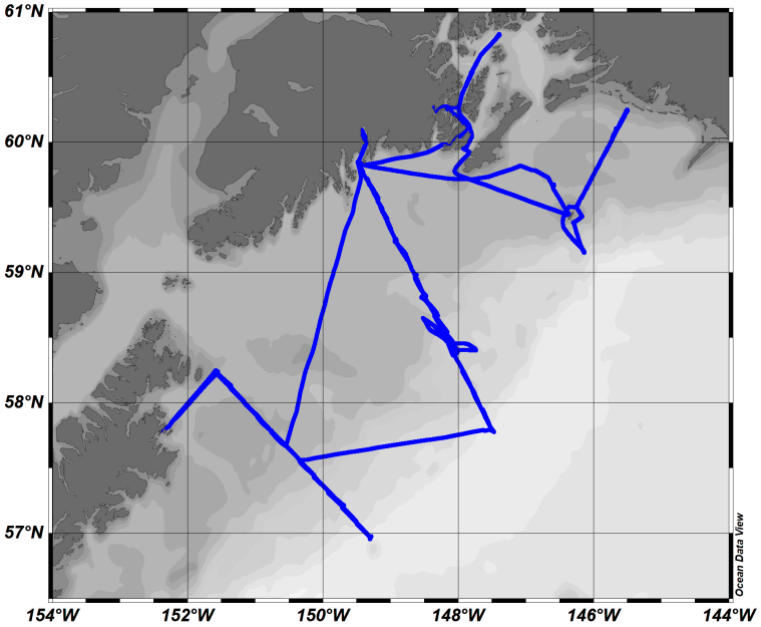

Figure 2. Cruise track for Tiglax from April 26-May 8, 2019 (TxS19)

Underway data from this vessel consisted of a newly purchased meteorological system (wind velocity, barometric pressure, air temperature, relative humidity, and PAR) and a TSG. The normal SBE-21 Thermo-salinograph failed during transit to this cruise and was replaced with SBE-45 that had frequent issues with interfacing to the GPS (GPS from Meteorological system was spliced to TSG post-cruise). Logging occurs in the bridge's computer room. There were several data gaps in TSG record.

Hydrographic data showed very little thermal stratification on all transects but slightly more in oceanic waters (Fig. 3-5). Salinity showed only a minor depression in the Alaska Coastal Current along the Seward Line. Nitrate was only significantly reduced in the ACC and the outer stations of the Kodiak line, consistent with increased chlorophyll-a fluorescence at those locations. Dissolved oxygen appeared to decline rapidly below 100m in oceanic waters. Compared to the 22-year record along the Seward Line, temperatures averaged across the upper 100m were 0.64°C above the mean and were the warmest observed outside a strong El Niño or the recent marine heat-wave (Fig.6). Underway data shows sea surface temperature generally 7-8°C, and the depression of salinity within Prince William Sound and the ACC (Fig.7). Air temperatures were slightly cooler than those of the ocean, and winds were generally favorable with the notable exception of the storms that shut down sampling (Figure 8).

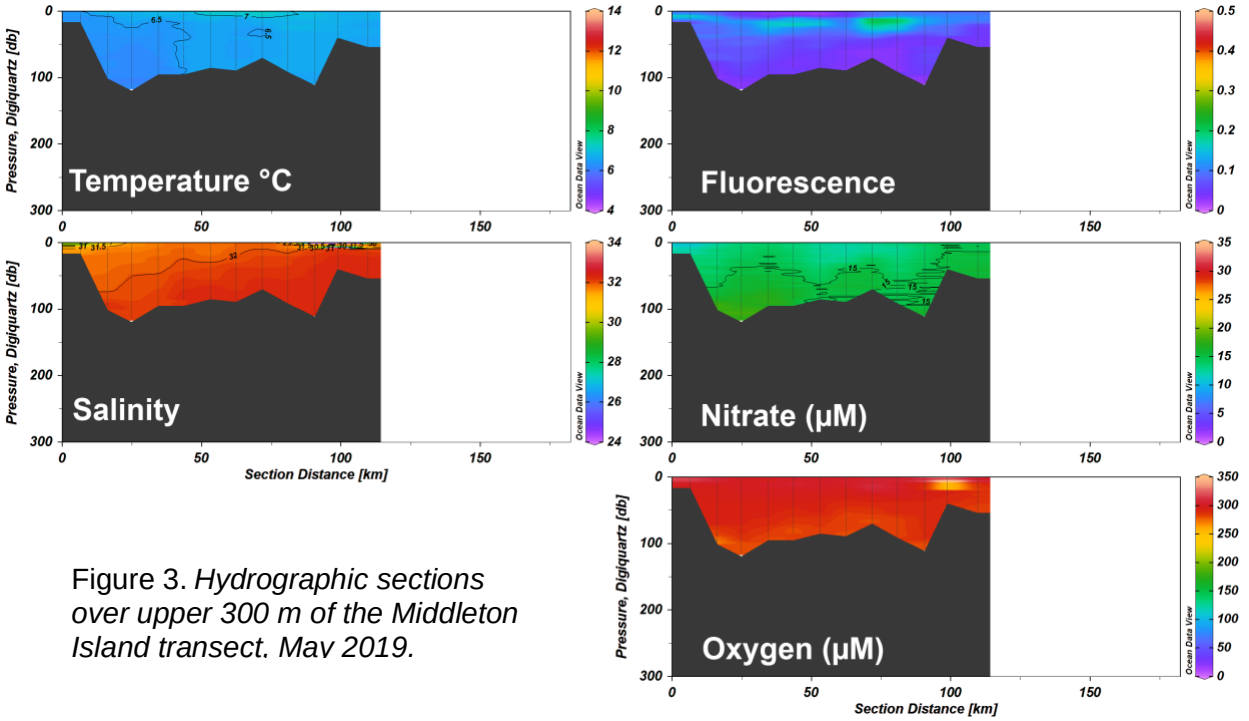

Figure 3. *Hydrographic sections over upper 300 m of the Middleton Island transect. May 2019.*

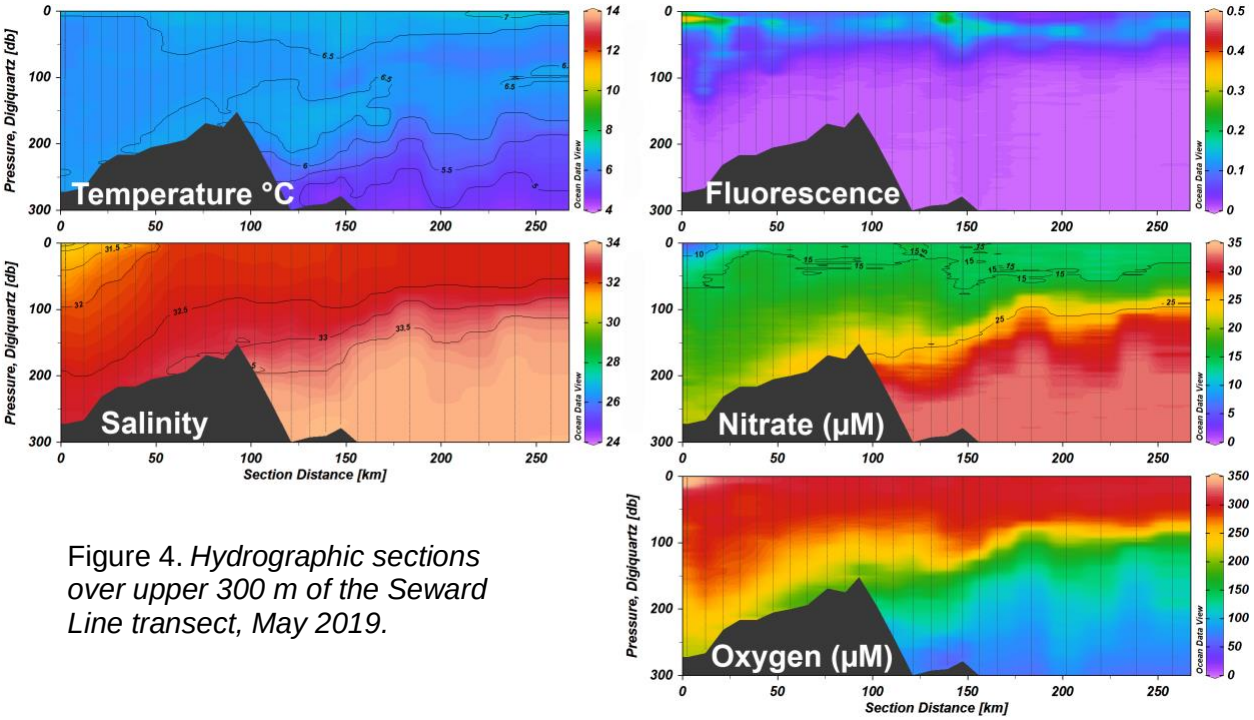

Figure 4. *Hydrographic sections over upper 300 m of the Seward Line transect, May 2019.*

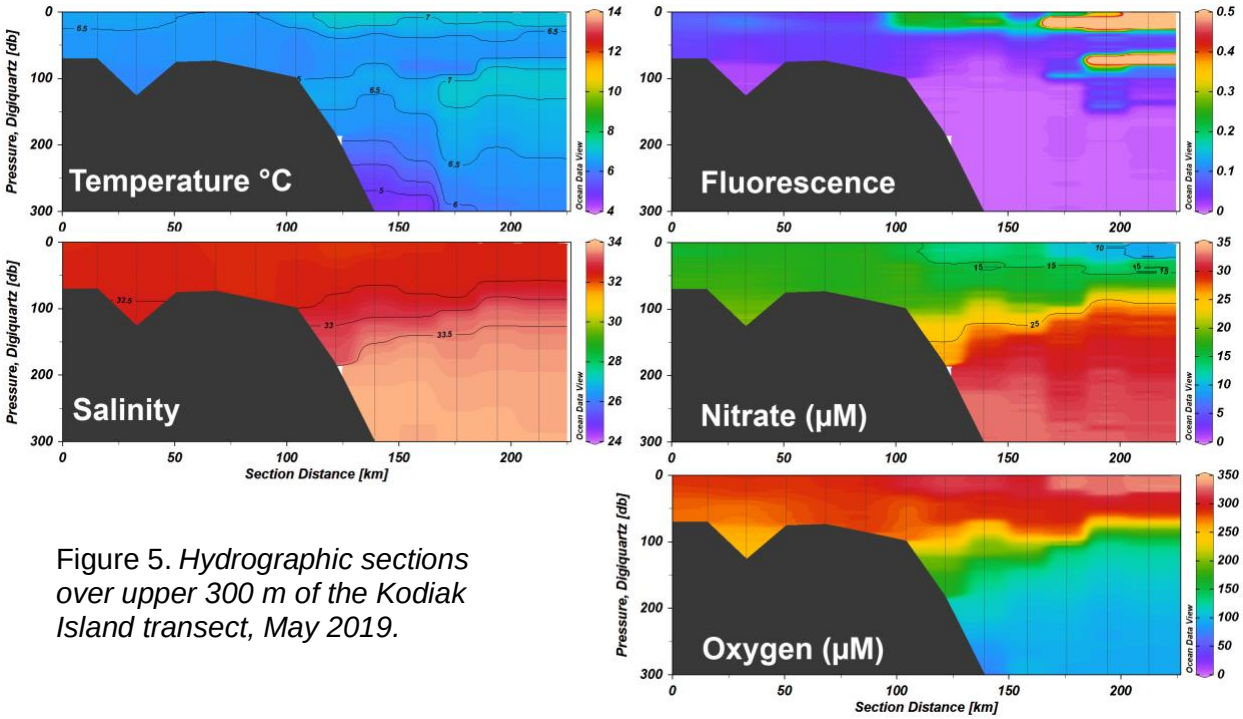

Figure 5. *Hydrographic sections over upper 300 m of the Kodiak Island transect, May 2019.*

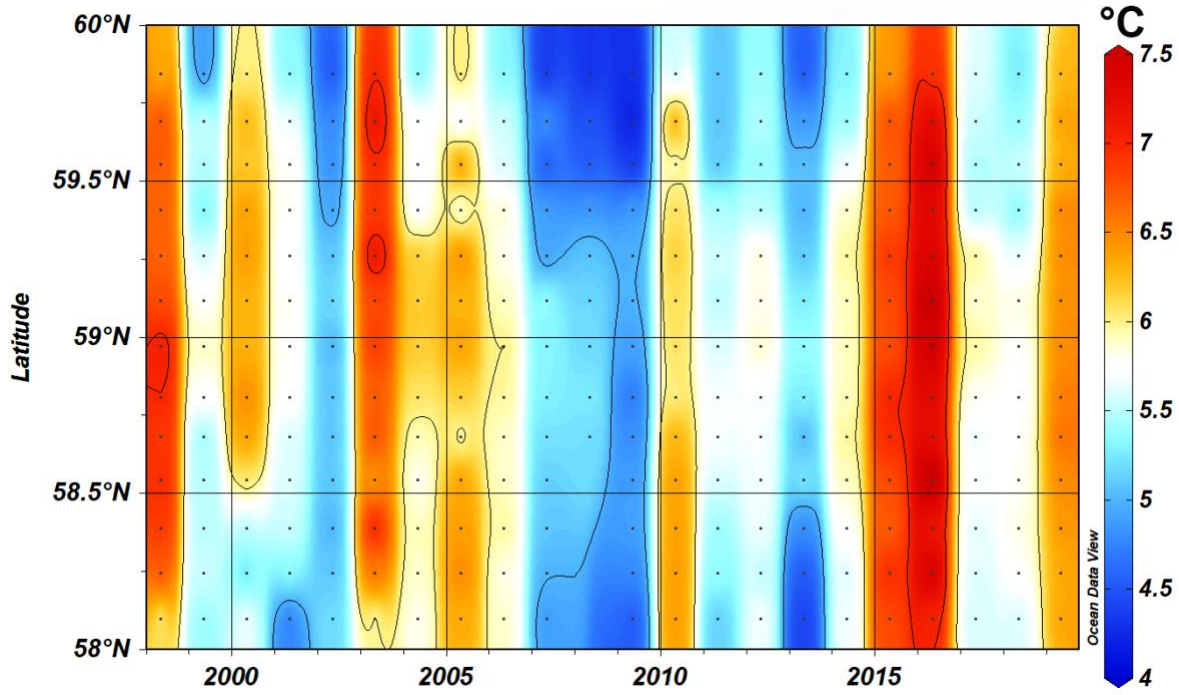

Figure 6. Average temperature in the upper 100m of the water column along the Seward Line during May over the duration of the time-series.

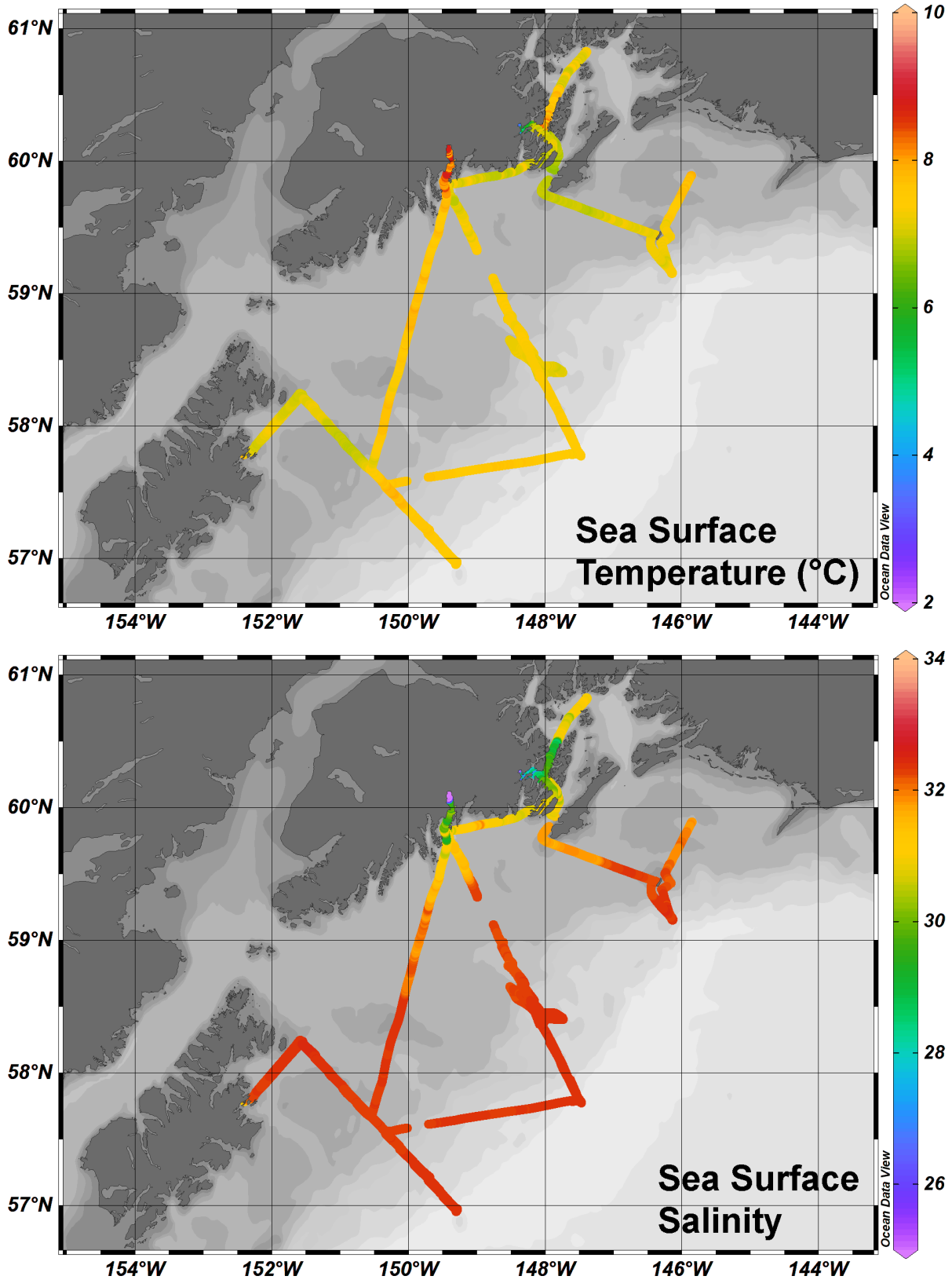

Figure 7. Underway data (~3 m depth) during April-May 2019 (TxS19).

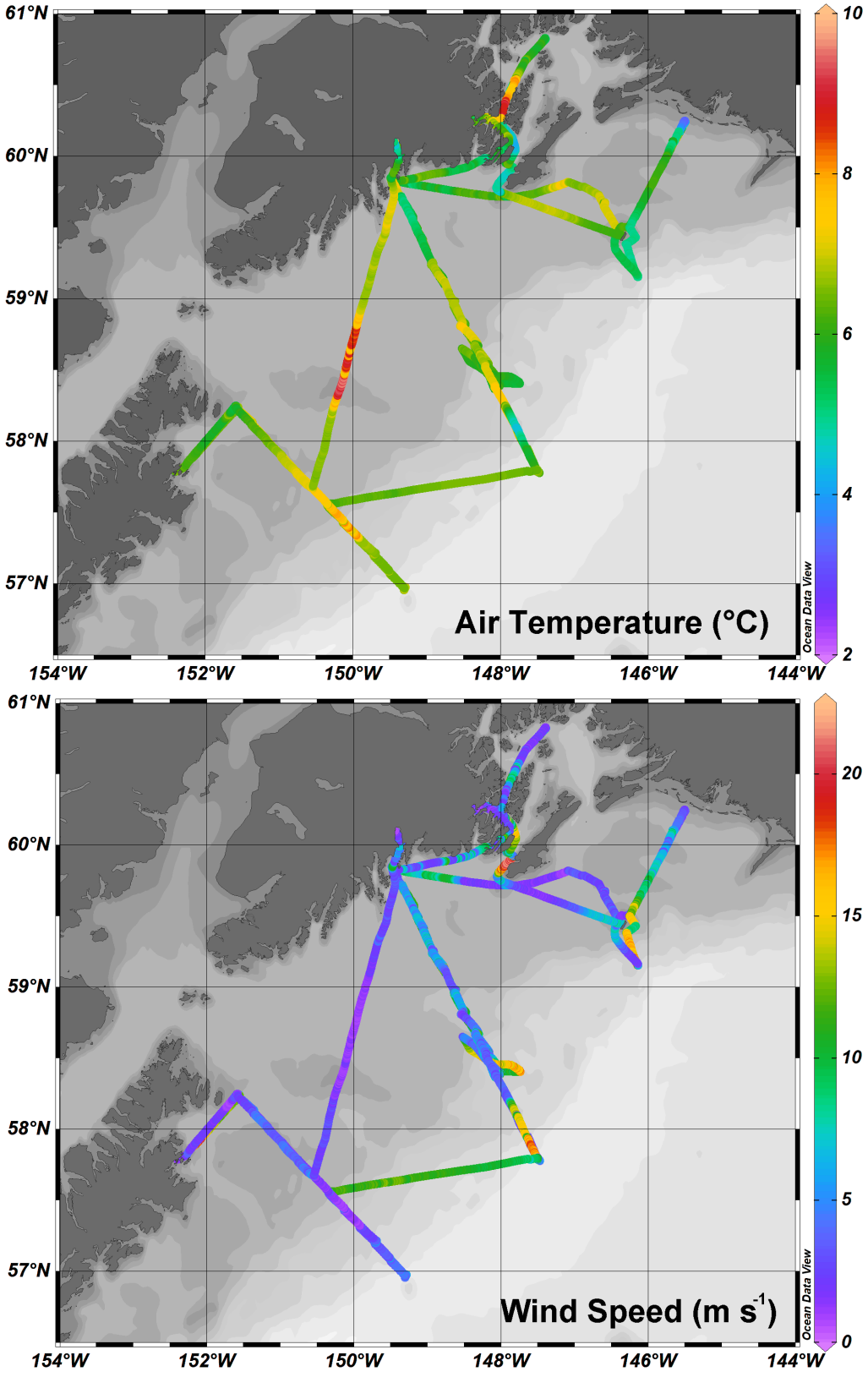

Figure 8. Underway weather during April-May 2019 cruise aboard R/V Tiglax.

Macro- and Micronutrient sample collection and processing

PI: Ana M. Aguilar-Islas
Participants: Ana Aguilar-Islas and Annie Kandel (MS student)

The goal of this field effort was to determine ambient distribution of dissolved inorganic macronutrients (nitrate, nitrite, ammonium, phosphate and silicic acid) and the micronutrient iron. Nutrient distributions in conjunction with hydrography are used to determine resource variability to the phytoplankton community in space and time and to identify the relative importance of various processes in supplying nutrients to surface waters. This cruise also provided field research experience to a MS student from UAF. This was her first oceanographic expedition.

Sample collection and processing for macronutrient analysis:

Filtered seawater samples were collected from surface to a depth of 1000 m from 41 vertical profiles using the UAF CTD rosette bottles (see Table 1). Samples were filtered through 0.45 µm cellulose acetate filter disks using a syringe, and were kept frozen (-40 $_{o}$C) following collection. Samples were also obtained from primary production casts (48 samples), and from the surface FeFish (6 samples). Annie Kandel was responsible for sampling and logging. In total 532 samples were collected for nutrient analysis.

Table 1 Nutrient Sample Collection

Date	Stations	# of samples
4/26/19	RES2.5	13
4/28/19	MID1-6	38
4/29/19	MS2	11
4/30/19	PWSA, PWS1-3, IB0-2	91
5/1/19	GAK1-4	46
5/2/19	GAK5-8	46
5/4/19	GAK9-15	102
5/6/19	KOD6-12	93
5/8/19	KOD1-5	38
Total	**41 Stations**	**478 samples**
Primary Production	MID2, PWS2, GAK1, GAK5, GAK9, GAK15, KOD10, KOD5	48
Extra Surface FeFish	KOD12-KOD8	6
GRAND TOTAL		**532**

Sample collection for iron analysis:

The *R/V Tiglax* is an adequate platform for collecting surface samples for Fe analysis, but under current configurations vertical sampling is not possible. Surface seawater samples were collected underway in between stations (see Table 2). These samples were obtained from a custom-made surface sampler (FeFish) deployed from the starboard crane, and kept at a distance of ~ 5 m from the hull of the ship. Aguilar-Islas involved in deck operations with assistance from the crew. In total, 168 samples (Table 2) were collected for analysis of Fe parameters. Seawater was brought into a trace metal clean van outfitted with HEPA filtered air where collection and processing took place.

Sample processing for iron analysis:

A small enclosure was built inside the van for sample processing. Samples were filtered in-line (Acropak 0.2 µm cartridges) for the analysis of dissolved iron and iron-binding organic ligands. Unfiltered samples were collected for total dissolvable iron analysis, and for particulate iron analysis (through 0.2 um polycarbonate filter discs). Ultrafiltered samples (through 0.02um Anotop syringe filters) were collected for soluble Fe analysis. Aguilar-Islas was responsible for all sample collection and off-line filtration.

Table 2. Samples for iron parameters

Line	Date	DFe	TDFe	SFe	Ligands	PFe	Total Samples
GAK	5/1, 5/1, 5/4	48	7	7	7	7	76
GAK to KOD	5/5	2	-	-	-	-	2
KOD	5/6, 5/8	35	7	5	6	7	60
MID	4/28	16	2	1	2	2	23
PWS	4/30	3	1	1	1	1	7
Total		**104**	**17**	**14**	**16**	**17**	**168**

DFe = dissolved iron (< 0.2 µm), TDFe = total dissolvable iron (unfiltered),
SFe = soluble Fe (< 0.02 µm), PFe = particulate iron (> 0.2 µm)

General Notes about the use of the Tiglax

DECK OPERATIONS: The use of the Tiglax for our LTER operations was adequate for the collection of trace-metal clean surface water and the collection of nutrient samples from the CTD. The deck crew provided excellent support; their help ensured the success of our FeFish deployments. A member of Aguilar-Islas' team is always in charge of FeFish deployment and recovery. The crew was also helpful during loading/offloading and always behaved in a professional manner.

LAB SPACE: Due to limited lab space on this ship, a working van is essential for Fe work. The ship was able to provide electric power to the van and compressed air to the FeFish pump. The location of the van is adequate during calm conditions, but access to the van becomes a safety issue during rough weather.

ISSUES DURING CRUISE: Weather prevented sampling from MID 7 to MID 10.
Electrical problems surfaced after connecting the TM clean van to the ship. When the TM clean van was initially connected to the ship's power (main deck lab), there were issues with the ship's breakers. A new plug and a new cord did not fix the problem. Eventually the van was connected to the wheelhouse, and the breaker issue went away, but there was a ground fault that was large. The van had to be unplugged in the evenings to avoid the ground fault (when the van was not needed) at times when the van space was not needed. After consulting with their electrician on land, it was decided to test all the different components of the van to isolate the culprit. The outlets of the van seem to be the problem. The electricity in the van was altered to only have the lights connected directly from the van's power cord to the wheelhouse. A long extension cord and power strips were used to power all other van components (refrigerator, heap units, pumps, computers) to circumvent the ground problem.

The underway system continues to have problems keeping time (and sometimes location, and salinity). Time stamps and GPS coordinates from the new meteorological system will have to be merged with underway data to obtain T and S and the correct time and locations.

Carbonate Chemistry

PI: Claudine Hauri, Participant: Stephanie O'Daly

Pre-filtered DIC samples were taken from as many depths and stations as possible given time and water restrictions. Samples were filtered with a 0.45 micron membrane filter using a peristaltic pump to remove PIC. It took about 5 minutes per sample, so no more than 6 samples of DIC were possible between casts when there were intermediate stations. Duplicates were taken when possible for a total of 6 pairs of duplicates throughout the cruise. During productivity casts, if the light level depths were within ± 2 m of a DIC depth. we adjusted the DIC depth so these overlapped. This occurred on 8 casts over the course of the cruise (Table 3). An independent set of triplicate samples were collected from the surface and bottom bottles of GAK1 to be analyzed at UAF's OARC.

Table 3. DIC sample taken during April-May of 2019 from Tiglax.

Station ID	Cast Description	Cast #	Samples # Taken
MID1		3	1
MID2	Prod	5	5
MID2	Intensive	6	2
MID3		8	6
MID5		12	5
PWS2	Prod	23	5
PWS2	Intensive	24	7
GAK1	Shallow	30	3
GAK1	Deep	31	4
GAK1	Prod	32	4
GAK2		34	5
GAK3		36	5
GAK4		38	5
GAK5	Intensive	40	5
GAK5	Prod	41	5
GAK6		43	5
GAK7		45	6
GAK8		47	5
GAK9	Intensive	49	6
GAK9	Prod	50	5
GAK10		52	6
GAK11		53	6
GAK12		54	6
GAK13		55	6
GAK14		56	6
GAK15	Intensive	57	6
GAK15	Prod	58	4
KOD12		59	6
KOD11		60	6
KOD10	Prod	61	5
KOD10	Intensive	62	5
KOD9		63	6
KOD8		64	6
KOD7		65	5
KOD6		66	5
KOD1		67	4
KOD2		68	5
KOD3		69	5
KOD4		70	5
KOD5	Prod	71	5
KOD5	Intensive	72	3

Particles

PI: Andrew McDonnell, Participant: Stephanie O'Daly

The LISST collected particle size and abundance data for all CTD casts. A backscatter was performed at the start and end of the cruise to determine if any drift occurred in the instrument.

The depth trigger on the UVP was not functioning. We were not able to collect profiles at Middleton Line 1 – 5, but full transects of GAK and Kodiak were collected using I/O manual start stop. Additionally, all casts in Prince William Sound and Icy Bay were collected. The battery ran out on the deep cast at GAK 15 cast 57, so only a 200 m profile was collected. In total, 57 profiles were collected with the UVP.

Phytoplankton and Microzooplankton

PI: Suzanne Strom
Participants: Suzanne Strom (WWU), Kerri Fredrickson (WWU), Isaac Reister (SeaBird Electronics, volunteer)

Phytoplankton biomass and performance: Phytoplankton biomass was characterized by size-fractionated (>20 µm; <20 µm) chlorophyll at all non-intermediate shelf stations and most PWS stations (total = 42 vertical profiles); only total chl (GFF) was measured in Icy Bay due to interference of suspended glacial flour particles with the size-fractionation process. Samples were analyzed fluorimetrically on board (7 depths per station). Primary production estimates were made at all intensive stations (total = 8; note that the outer Middleton Line was not sampled at all on this cruise) using the 13-C method and 24-h deck incubations. Six 'light depths' were sampled per station based on the attenuation coefficient as estimated from the CTD PAR profile. Based on 2018 data, no dark bottle was included in the productivity incubations. Chlorophyll (GFF only) and nutrient samples were also taken from each of these productivity depths during experiment set-up. During two productivity experiments (PWS-2 and GAK-15), duplicate trace metal-cleaned bottles were filled from the iron fish and from two surface Niskins for inoculation with ultra-clean 13C stocks in Ana's Fe van, for comparison with duplicate surface bottles collected and handled in the normal manner. This was a test to determine whether lack of trace metal clean techniques affects the primary production estimate, particularly in offshore waters. DIC samples for C. Hauri were collected at some of the same depths as productivity samples on all 8 prod casts, affording the opportunity for comparison of measured versus estimated (for productivity calculation) DIC concentrations.

Community characterization: Photosynthetic organisms and other protists were sampled at approximately every other shelf station, generally at 10 m depth only, as well as at selected stations in PWS. Samples were fixed in acid Lugol's for standard microzooplankton biomass and composition estimates, and in borate-buffered formalin for characterization of diatoms. Additional samples collected in conjunction with our mixotrophy project were i) fixed in glutaraldehyde, DAPI-stained, and made into slides for biomass and composition of nano- and picoplankton, and ii) fixed in HMTA-buffered formalin for inverted-epifluorescence microscopy to assess mixotrophy in ciliates and larger dinoflagellates. At intensive stations only, additional samples were taken from 10 and either 0 or 30 m for HPLC analysis of phytoplankton pigments (chemotaxonomy) and from 10 m only (in duplicate) for molecular characterization (18s rRNA) of the protist community by T. Rynearson. Additional 10 m samples for molecular analysis of diatoms (for J. Gann, UAF graduate student) were collected at odd-numbered Seward Line stations. At intensive stations a 4-depth vertical profile of acid Lugol's samples was also collected.

Organic carbon characterization: Samples were filtered and frozen at intensive stations plus a few others (total = 10) for DOC profiles; depths sampled were mainly 150 m and above, and corresponded to nutrient sampling depths. Deeper samples (to 1000 m) were taken at Seward Line intensive stations and at KOD-10. At intensive stations only, a 4-depth vertical profile (10, 30, 50, 75 m; sometimes adjusted slightly to match productivity and DIC depths) was sampled for POC and PIC.

Preliminary observations:

Weather was a big factor in the sampling accomplished on this cruise. We lost all or part of 3 days due to winds and high seas, including the outer MID line and intensive station MID-5 (scheduled for 29 April, when we instead headed for PWS). On 3 May we sat near GAK-9 but could not sample; on 7 May we spent the day tied up in Kodiak after the night work.

There were mesoscale eddies apparent in satellite altimetry near the ends of the MID line and the KOD line, with the latter containing a clear high chlorophyll core and outer bands (from MODIS Aqua). The KOD line was extended 20 nautical miles beyond KOD-10 to include two new stations, the outermost (KOD-12) located approximately in the middle of the eddy. Eddy stations KOD-12, and 11 were warm (>7°C) in the upper 30 m and both showed a substantial near-surface chlorophyll maximum and a discrete deeper (~75 m) maximum, both layers made up mainly of >20 µm cells (see figure below). We sampled both stations heavily for microscopy, HPLC, and molecular characterization. In addition, near-surface size-fractionated chlorophyll samples were collected at ~15 min intervals by the iron fish in transit between all stations from KOD-12 inshore to KOD-8 to define the horizontal chlorophyll gradient associated with the eddy.

Highest chlorophyll concentrations of the cruise were in the upper 30 m in PWS, associated with a diatom bloom. The community on the MID line (MID-1 through MID-6) was almost entirely small cells at modest chlorophyll concentrations (<2 µg/L), as was the GAK line offshore of GAK-3, implying a spring community that was starting to develop (chlorophyll concentrations higher than winter) but had not yet transitioned to a diatom bloom. The KOD line was a complex mix of a depth-layered diatom bloom associated with the eddy, small cell-dominated communities like those predominant on the GAK and MID lines, and a mixed community over parts of Albatross Bank.

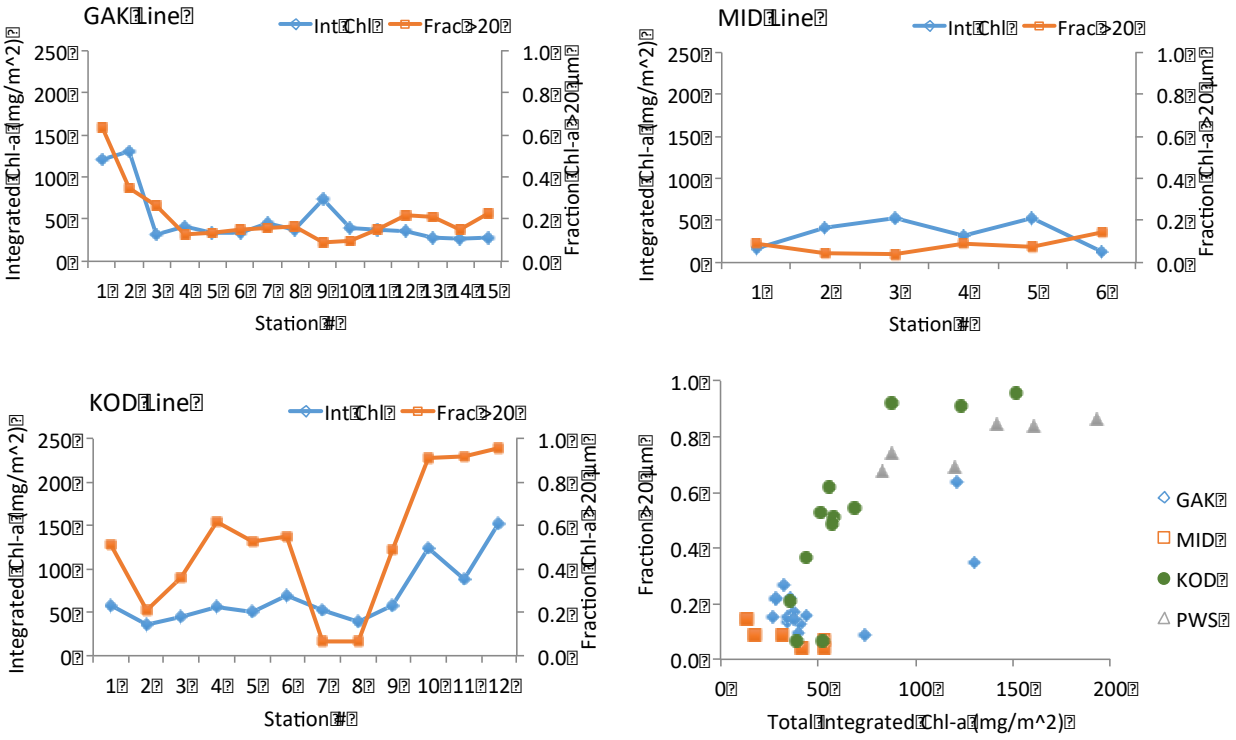

Figure 8. Size-fractioned chlorophyll collected along transects during April-May 2019

Table 4. Sampling effort for Strom component, by station. Intensive stations are highlighted.

Station	Chl SF	Chl Tot	Lugols uzoo Prof	Lugols uzoo 10m	Diatom	Mixo	Nano	DOC	Molecular HPLC	Molecular TAR	Molecular JG	POC/PIC	Prod
Res 2.5	x												
MID1	x			x	x			x					
MID2	x		x		x	x	x	x	x	x		x	x
MID3	x			x	x								
MID4	x			x	x								
MID5	x												
MID6	x												
MS2	x			x	x								
PWSA	x			x	x								
PWS3	x												
PWS2	x		x		x	x	x	x	x	x		x	x
PWS1	x												
KIP2	x												
IB1		x											
IB0		x											
GAK1	x		x		x	x	x	x	x	x	x	x	x
GAK2	x												
GAK3	x			x	x								
GAK4	x												
GAK5	x		x		x	x	x	x	x	x	x	x	x
GAK6	x												
GAK7	x			x	x						x		
GAK8	x												
GAK9	x		x		x	x	x	x	x	x	x	x	x
GAK10	x												
GAK11	x			x	x						x		
GAK12	x												
GAK13	x			x	x						x		
GAK14	x												
GAK15	x		x		x	x	x	x	x	x	x	x	x
KOD12	x		x		x	x	x		x	x			
KOD11	x		x		x	x	x		x	x			
KOD10	x		x		x	x	x	x	x	x		x	x
KOD9	x												
KOD8	x												
KOD7	x			x	x	x	x						
KOD6	x												
KOD1	x			x	x			x					
KOD2	x												
KOD3	x			x	x								
KOD4	x												
KOD5	x		x		x	x	x	x	x	x		x	x
Total	**40**	**2**	**10**	**12**	**22**	**11**	**11**	**10**	**21**	**10**	**7**	**8**	**8**

Table Key:

SF Chl: size-fractionated chlorophyll-a; water sample filtered in series through a 20 µm pre-size filter followed by a glass fiber filter (effective pore size 0.7 µm)

Tot Chl: total chlorophyll-a; water sample filtered through glass fiber filter only

Lugol's µzoo: water sample preserved in acid Lugol's iodine solution (final concentration 5%) for microscopy analysis of size and composition of ciliate and dinoflagellate microzooplankton (cells ≥15 µm). Samples collected from either 10 m or in a 4-5 depth vertical profile.

Diatom: water sample preserved in borate-buffered formalin (final concentration 2%) for microscopy analysis of diatom community.

Mixo: water sample preserved in HMTA-buffered formalin (final concentration 10%) and stored in refrigerator for microscopy analysis of mixotrophic ciliates and dinoflagellates.

Nano: water sample pre-screened through 100 µm Nitex mesh, preserved in glutaraldehyde (final concentration 0.5%), and stained with DAPI for on-board filtration and slide preparation. Slides stored frozen for epifluorescence microscopy analysis of cyanobacteria and protists <20 µm in size.

HPLC: water sample filtered (glass fiber, 0.7 µm) and frozen in liquid N2 for HPLC analysis of phytoplankton pigments (chemotaxonomy).

Molecular: water sample filtered (0.2 µm) and frozen in liquid N2 for molecular analysis of eukaryotic microbial community composition. TAR: samples for Tatiana Rynearson (URI); JG: samples for diatom characterization by Jeanette Gann (UAF/NOAA).

DOC: water sample filtered directly from Niskin through in-line pre-combusted glass fiber filter and filtrate stored frozen for analysis of dissolved organic carbon concentration.

POC/PIC: Paired samples from a single Niskin filtered through pre-combusted glass fiber filters and filters stored frozen for analysis of particulate organic and particulate inorganic carbon. Increased filtered volume on this cruise to 2.3 L per sample for all but high chlorophyll depths/stations.

Prod: Water column primary productivity measured via 24-h incubation of samples from different depths with 13C-labeled sodium bicarbonate.

Meso/Macro Zooplankton

PI: Hopcroft, Participants: Ken Coyle, Caitlin Smoot, Alex Poje, Katie Gavenus (teacher);

Zooplankton sampling operations were divided into distinct day and night activities. During daytime, Quadnets (Quad frame has 4 nets, 2 of 150µm mesh and 2 of 53µm mesh) casts were conducted at all stations (except "i" stations) to 100m depth, or within 5m of the bottom at shallower stations. At intensive stations an additional Quadnet cast was taken, with the 150um net preserved in ethanol for molecular studies and the 53µm nets used for live sorting. Additionally, at intensive stations along the Seward Line and at PWS2, a multinet equipped with 150µm-mesh nets was deployed vertically to 200 m (shelf) with a second cast deployed to 750m (PWS2) or 1200m (GAK15) dividing strata at 600, 400, 300, 200,100, 60, 40, and 20 m. During night-time a Bongo net of 505µm mesh was towed obliquely to 200m depth (or 5 m above the bottom) at all shelf stations except for the Seward Line. Bongo depths were monitored using a Fastcat (SBE49) CTD mounted immediately above the nets. Along the Seward Line and within PWS, a multinet equipped with 505µm-mesh nets was towed obliquely to 200m depth (or 5 m above the bottom) dividing strata at 100, 60, 40, and 20 m. All standard gear was deployed without notable issues.

At all intensive stations, samples were sorted for *Neocalanus* species and life-stages to image for body size and lipid sac volume (~50 for each species/stage combination). In general, an entire net was sorted, allowing a preliminary estimate of their species abundances.

PI: Petra H. Lenz & Russ Hopcroft

Project Goals: *Neocalanus* preparation for diapause during the spring phytoplankton bloom (NSF project - UHM & UAF; PIs: Lenz, Hopcroft, Christie and Hartline) – transcriptional profiling of individuals in the genus *Neocalanus* in the pre-adult stage CV and *Calanus marshallae* in PWS and NGA. 2019 marks the 5th year of spring collection of *Neocalanus flemingeri* from selected stations. Since the start of the LTER program, target stations include current intensive stations in Prince William Sound (PWS2, PWSA), Seward Line (GAK1, GAK5, GAK9 and GAK15), Kodiak Line (KOD5 and KOD10) and Middleton Island Line (MID2 and MID5).

Research Activities:

- Live sorted copepods collected with CalVET net (53 µm, 100 m depth) from stations: MID2, PWS2, GAK1, GAK5, GAK9, GAK15, KOD10 and KOD2. *N. flemingeri* stage CV preserved in RNAlater from all stations (3 – 8 individuals per station). Additional species included *C. marshallae* (stage CV) from PWS2, and *N. cristatus* (stage CV) from GAK9, GAK15 and KOD10, and *N. plumchrus* from GAK9.
- Participated in obtaining images of *N. flemingeri*, *N. plumchrus* and *N. cristatus* for prosome length & width and lipid sac volume. Stage CIV and CV were imaged from stations MID2, PWS2, GAK1, GAK5, GAK9, GAK15 & KOD10. None imaged from KOD5 since *Neocalanus* spp. were simply not present (3 individuals were found in one of the net samples, and these were preserved for sequencing).
- Deep collections with MultiNet (150 µm mesh nets) towed vertically from depth (PWS2: 780 m, GAK15: 1,200 m) for preserved samples to check for the presence of diapausing individuals (no aggregations of *Neocalanus* at > 300 m found).
- Collected *N. flemingeri* for experimental incubations at Seward Marine Center from PWS2, GAK1 and GAK9.
- Assisted with other zooplankton collections

Marine bird and marine mammal surveys (USFWS)

PI: Kathy Kuletz, Participants: Dan Cushing, Callie Gesmundo

Background

We conducted marine bird and marine mammal surveys in the Northern Gulf of Alaska (NGA), April 23 to May 9, 2019, aboard the 37-m R/V *Tiglax*, as a component of the NGA Long-term Ecological Research / Seward Line (NGA-LTER) cruise led by chief scientist Russell Hopcroft of the University of Alaska Fairbanks. Immediately prior to the NGA-LTER cruise, we conducted additional surveys in the study area during an acoustic mooring deployment led by chief scientist John Hurwitz of Scripps Institute of Oceanography. The *Tiglax* departed Homer on April 23, deployed two acoustic moorings on the continental slope, and arrived in Seward on April 25. The vessel then departed Seward on April 26 for the NGA-LTER cruise, sampled at stations organized along three cross-shelf lines located between Kodiak Island and the Copper River, as well as in Prince William Sound (PWS; Figure 1), and returned to Seward on May 9. Surveys were conducted when transiting between individual stations, sampling lines, and ports of call.

Methods

Observer D. Cushing conducted visual surveys during daylight hours while the vessel was underway. Surveys were conducted from the flying bridge, using a modified line-transect protocol. The observer searched an area within a 300-m, 90◦ arc from the bow to the beam, using hand-held 10x binoculars when necessary for species identification. Observations were recorded using four perpendicular distance bins: 0-50m, 51-100m, 101-200m, and 201-300m. Observations of rare birds or large flocks, or marine mammals observed outside of the sampling window were recorded as “off-transect”. The behavior of each animal was recorded as flying, on water, on ice, or foraging. Birds and mammals on the water or ice, or actively foraging from the air, were recorded continuously. Flying birds were recorded using instantaneous scans (frequency based on ship speed, typically about 1 per minute), to minimize bias due to movement of flying birds. Observations were recorded directly into a laptop computer using software Dlogv3 (R.G. Ford Consulting, Portland, OR) which logged the geographic coordinates of each sighting, as well as the track line and environmental conditions (Beaufort Sea state, weather, glare, ice coverage) at 20 sec intervals. We encountered glacial ice in the vicinity of Icy Bay in PWS. Following completion of the cruise, survey transects were subdivided into 3-km segments, and density values (birds/km$_2$) were calculated for each taxon in each transect segment.

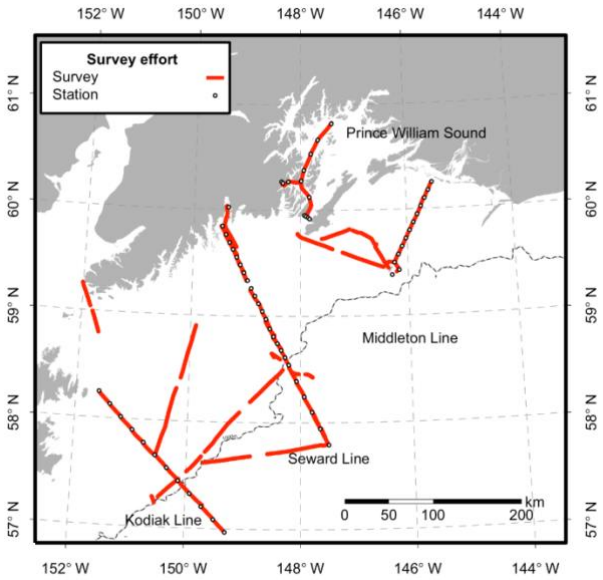

Figure 9. Location of seabird and marine mammal transects during Apr-May 2019.

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Results

We conducted a total of 1422 linear km of surveys during the April-May 2019 cruise (Figure 9). On-transect, we observed a total of 3235 individuals of 39 species of birds, with an additional 10 species observed off-transect during surveys or while at stations (Table 5). Averaged across all 3-km transect segments, the mean density (all bird species combined) was 8.5 birds/km$_2$, compared to 6.2 birds/km$_2$ during April-May 2018. During April-May 2019, sooty and short-tailed shearwaters averaged 3.4 birds/km$_2$, while they averaged 0.4 birds/km$_2$ during spring 2018. Thus, while shearwaters were much more abundant during spring 2019 than during the prior spring, densities of all other species combined were slightly lower.

Combined, sooty and short-tailed shearwaters made up 37% of all birds observed during the spring 2019 cruise (Table 5). The two shearwater species differed in their spatial distribution; sooty shearwaters were widely distributed, and predominated at Lower Cook Inlet, Cape Cleare, and Middleton Island, while short-tailed shearwaters occurred in small numbers offshore, and in large flocks on the edges of the banks east of Kodiak (Figure 10).

The second most abundant species of seabird during the spring 2019 cruise was the northern fulmar, which made up 15% of bird observations (Figure 10). Fulmars were most abundant near the shelf-break. Few fulmars were observed on the inner or middle shelf on the Middleton and Seward Lines, while fulmars were widely distributed on the Kodiak Line.

Also abundant were black-legged kittiwake (10% of total birds), fork-tailed storm-petrel (9%), common murre (7%), and black-footed albatross (5%); no other species comprised 5% or more of the total. During spring 2019, kittiwakes were concentrated near Middleton Island, the shelf between Middleton Island and the mainland, PWS, the Kenai Coastline, and the Barren Islands (Figure 10). Few kittiwakes were observed over the middle and outer shelf, except near Middleton, and only one kittiwake observation occurred offshore of the 1000m isobath. Fork-tailed storm petrels were frequently observed along the shelf-break and in offshore waters. Few storm-petrels were observed over the shelf, with the exception of Portlock Bank. Common murres were primarily observed near colonies at Resurrection Bay, Middleton Island and the Barren Islands. Few murres were observed away from colony locations, and no murres were observed within PWS. Black-footed albatross were most numerous near the 1000m isobath, Laysan albatross comprised 20% of albatrosses and a single short-tailed albatross (stage 1 immature) was observed.

The abundance of murrelets was notable during the spring 2019 cruise; the two *Brachyramphus* murrelet species (marbled and Kittlitz's murrelet) totaled a combined 2.4% of all bird observations. Marbled murrelets occurred in coastal waters and were especially abundant at Cape Cleare. Groups of marbled murrelets were also encountered near Middleton Island. Kittlitz's murrelets were observed on the shelf roughly midway between Middleton and Montague Islands, at Cape Cleare, as well as in Icy Bay in PWS. In addition, ancient murrelets made up 0.3% of seabird observations, and occurred from the inner shelf to the slope in the western half of the study area.

During the cruise we observed the migration of ducks, geese, and loons. While many observations were within 20km of the coastline, migrating waterfowl and loons were also observed on the shelf between Middleton Island and the mainland. In addition, two groups of northern shovelers occurred offshore of the shelf break.

The most abundant toothed whale (odontocete) species observed was the Dall's porpoise (Table 6). Dall's porpoise were widely distributed, with the most frequent observations near the coastline and the shelf-break (Figure 11). Groups of killer whales were encountered on the shelf east of Kodiak and in PWS. Sperm whales were frequently observed on the continental slope. In addition, a sperm whale was observed in Knight Island Passage, near station KIP2 (Figure 11, where water depth was 585m. A sperm whale was also observed and photographed at station PWS1 in Knight Island Passage, where water depth was 350m.

During the spring 2019 cruise, the most abundant baleen whale (mysticete) species was the fin whale. Fin whales occurred near the shelf-break, and also in coastal areas including Resurrection Bay and PWS (Figure 12). Humpback whales were also observed in Resurrection Bay and PWS, with one additional sighting on the shelf east of Kodiak Island. In comparison, during Spring 2018, only a single humpback whale was observed, located in PWS. Minke whales occurred in Kennedy Entrance and near Middleton Island.

Harbor seals were abundant in Icy Bay in PWS, with a total of 240 hauled out on ice in Nassau Fjord (Figure 12). A total of eight northern fur seals were observed during the cruise, all on the shelf, on and between the Seward and Kodiak Lines. As usual, sea otters were observed near the coast in PWS and along the Kenai Peninsula.

Table 5. Marine birds observed during the April-May 2019 NGA-LTER cruise. Numbers include on-transect observations only. Species only observed off-transect during surveys or while on station are indicated by an asterisk.

Common name	Scientific name	Number	% of total
Canada goose	*Branta canadensis*	*	*
Northern shoveler	*Spatula clypeata*	4	0.1
American wigeon	*Mareca americana*	4	0.1
Mallard	*Anas platyrhynchos*	1	< 0.1
Northern pintail	*Anas acuta*	106	3.3
Green-winged teal	*Anas crecca*	*	*
Greater scaup	*Aythya marila*	2	0.1
Surf scoter	*Melanitta perspicillata*	*	*
White-winged scoter	*Melanitta fusca*	5	0.2
Black scoter	*Melanitta americana*	1	< 0.1
Scoter spp.	*Melanitta spp.*	2	0.1
Long-tailed duck	*Clangula hyemalus*	*	*
Barrow's goldeneye	*Bucephala islandica*	2	0.1
Whimbrel	*Numenius phaeopus*	*	*
Hudsonian godwit	*Limosa haemastica*	*	*
Black turnstone	*Arenaria melanocephala*	*	*
Red-necked phalarope	*Phalaropus lobatus*	36	1.1
Red phalarope	*Phalaropus fulicaria*	1	< 0.1
Shorebird spp.	*Charadriidae or Scolopacidae* spp.	2	0.1
Pomarine jaeger	*Stercorarius pomarinus*	6	0.2
Long-tailed jaeger	*Stercorarius longicaudus*	3	0.1
Jaeger spp.	*Stercorarius* spp.	3	0.1
Common murre	*Uria aalge*	218	6.7
Murre spp.	*Uria* spp.	4	0.1
Pigeon guillemot	*Cepphus columba*	5	0.2
Marbled murrelet	*Brachyramphus marmoratus*	44	1.4

Table 5 (continued).

Kittlitz's murrelet	*Brachyramphus brevirostris*	8	0.2
Marbled or Kittlitz's murrelet	*Brachyramphus* spp.	27	0.8
Ancient murrelet	*Synthliboramphus antiquus*	10	0.3
Cassin's auklet	*Ptychoramphus aleuticus*	2	0.1
Parakeet auklet	*Aethia psittacula*	2	0.1
Rhinoceros auklet	*Cerorhinca monocerata*	38	1.2
Horned puffin	*Fratercula corniculata*	1	0.0
Tufted puffin	*Fratercula cirrhata*	67	2.1
Alcid spp.	*Alcidae* spp.	4	0.1
Black-legged kittiwake	*Rissa tridactyla*	314	9.7
Sabine's gull	*Xema sabini*	2	0.1
Mew gull	*Larus canus*	1	< 0.1
Herring gull	*Larus argentatus*	12	0.4
Glaucous-winged gull	*Larus glaucescens*	133	4.1
Aleutian tern	*Onychoprion aleuticus*	*	*
Arctic tern	*Sterna paradisaea*	11	0.3
Tern spp.	*Sterna or Onychoprion* spp.	4	0.1
Pacific loon	*Gavia pacifica*	4	0.1
Yellow-billed loon	*Gavia adamsii*	*	*
Laysan albatross	*Phoebastria immutabilis*	37	1.1
Black-footed albatross	*Phoebastria nigripes*	152	4.7
Short-tailed albatross	*Phoebastria albatrus*	1	< 0.1
Northern fulmar	*Fulmarus glacialis*	465	14.4
Short-tailed shearwater	*Ardenna tenuirostris*	1011	31.3
Sooty shearwater	*Ardenna grisea*	91	2.8
Dark shearwater spp.	*Ardenna* spp.	104	3.2
Fork-tailed storm-petrel	*Oceanodroma furcata*	274	8.5
Leach's storm-petrel	*Oceanodroma leucorhoa*	8	0.2
Red-faced cormorant	*Phalacrocorax urile*	*	*
Pelagic cormorant	*Phalacrocorax pelagicus*	2	0.1
Northern harrier	*Circus hudsonius*	1	< 0.1
Bald eagle	*Haliaeetus leucocephalus*	*	*
Total		**3235**	**100.0**

Table 6. Marine mammal species observed during the April-May 2019 NGA-LTER cruise.

Common name	***Scientific name***	**Number on-transect**	**Number off-transect**
Fin whale	*Balaenoptera physalus*	0	16
Minke whale	*Balaenoptera acutorostrata*	2	2
Humpback whale	*Megaptera novaeangliae*	1	4
Sperm whale	*Physeter macrocephalus*	1	8
Killer whale	*Orcinus orca*	16	7
Whale spp.	*Cetacea* spp.	0	6
Dall's porpoise	*Phocoenoides dalli*	25	10
Northern fur seal	*Callorhinus ursinus*	5	3
Harbor seal	*Phoca vitulina*	0	240
Sea otter	*Enhydra lutris*	2	1
Total		**52**	**297**

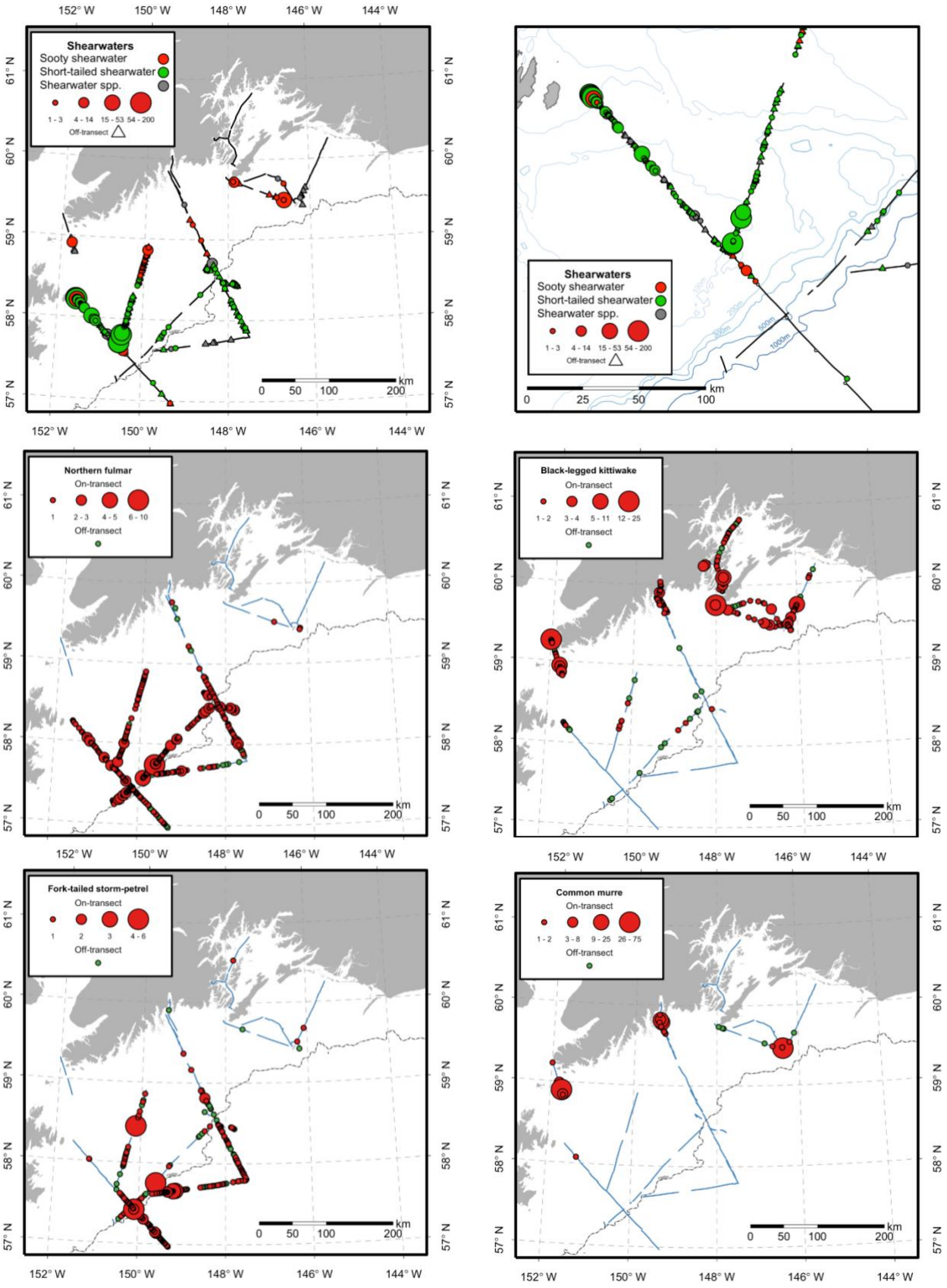
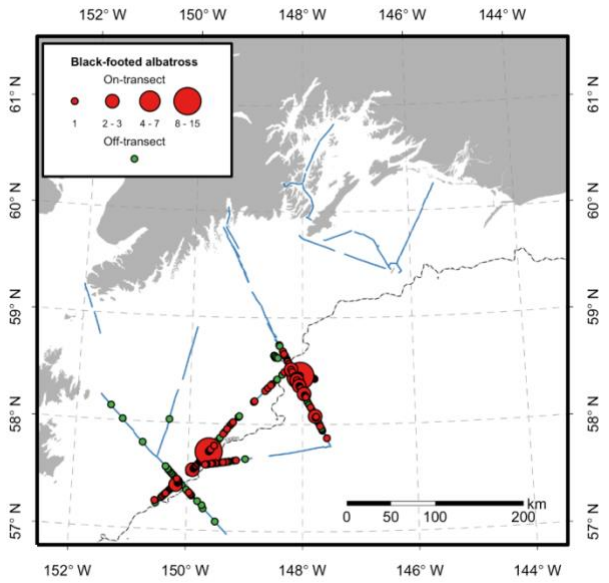


Figure 10. Most prominent seabird species during April-May 2019. Upper right: Albatross Bank.



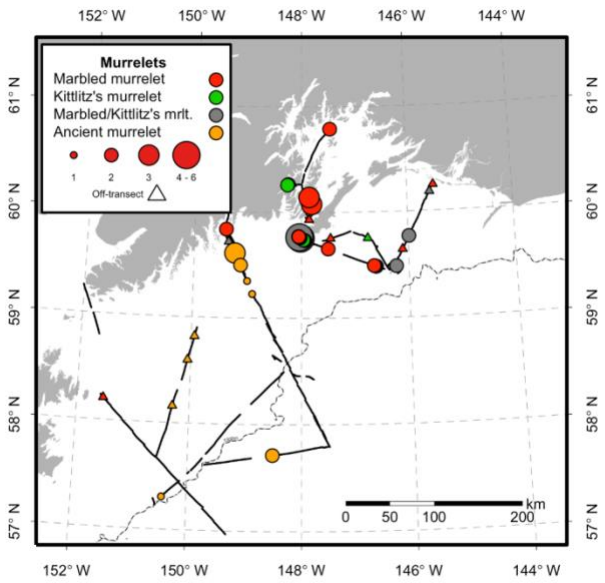


Figure 10 (Continued). Most prominent seabird species during April-May 2019.

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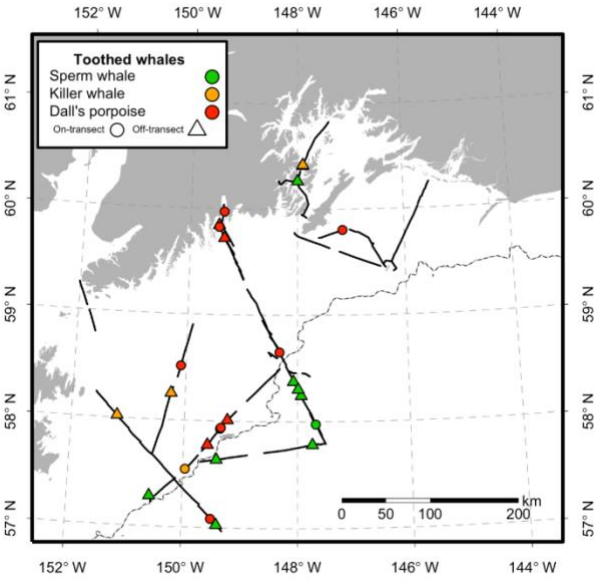

Figure 11. Toothed whales observed during April-May 2019. Image shows sperm whale near station KIP2 in Prince William Sound, April 30, 2019.

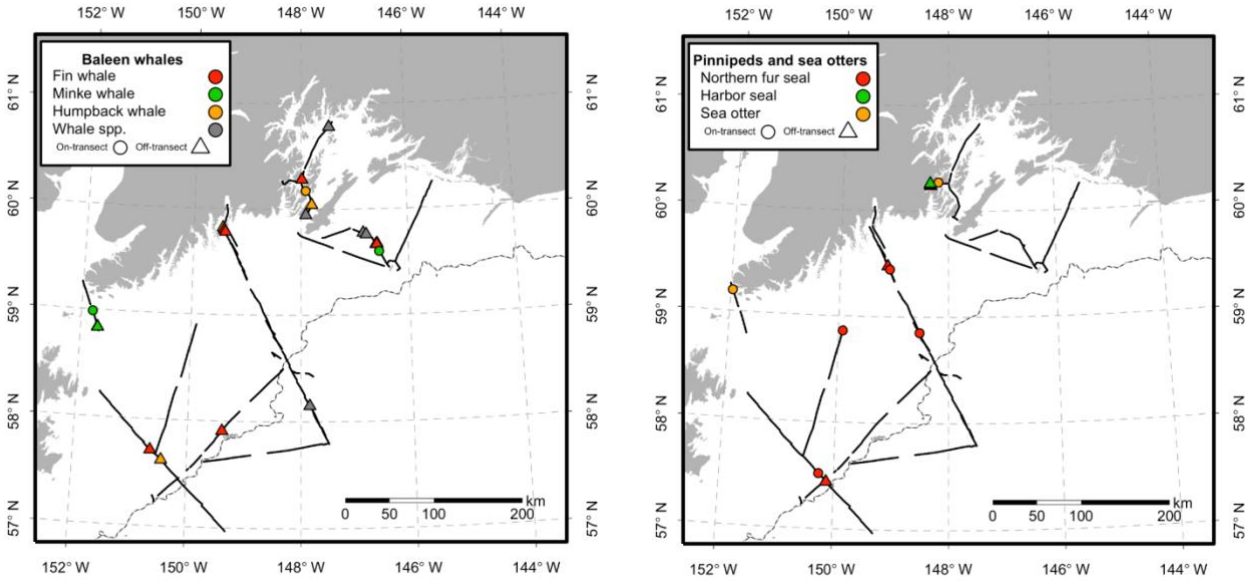

Figure 8. Baleen whales, pinnipeds and sea otters observed during April-May 2019.

Outreach

Teacher-at-sea Katie Gavenus joined us from Homer. She participated in Seward Line net sampling on night shift. At the end of the cruise she produced 5 blogs (roughly one every other day) describing various aspects of the cruise and our daily adventures (see https://noaateacheratsea.blog/category/2019/katie-gavenus/).

Appendix. STANDARD STATIONS (intensive stations highlighted)

Latitude N (degrees, minutes)		Longitude W (degrees, minutes)		Station Name	Depth
Resurrection Bay Station					
60	1.5	149	21.5	RES2.5	298
Seward Line					
59	50.7	149	28	GAK1	269
59	46	149	23.8	GAK1I	
59	41.5	149	19.6	GAK2	228
59	37.6	149	15.5	GAK2I	
59	33.2	149	11.3	GAK3	213
59	28.9	149	7.1	GAK3I	
59	24.5	149	2.9	GAK4	201
59	20.1	148	58.7	GAK4I	
59	15.7	148	54.5	GAK5	167
59	11.4	148	50.3	GAK5I	
59	7	148	46.2	GAK6	151
59	2.7	148	42	GAK6I	
58	58.3	148	37.8	GAK7	243
58	52.9	148	33.6	GAK7I	
58	48.5	148	29.4	GAK8	288
58	44.6	148	25.2	GAK8I	
58	40.8	148	21	GAK9	276
58	36.7	148	16.7	GAK9I	
58	32.5	148	12.7	GAK10	1459
58	23.3	148	4.3	GAK11	1410
58	14.6	147	56	GAK12	2134
58	5.9	147	47.6	GAK13	2058
57	*56.6*	*147*	*39*	*GAK14*	*3518*
57	*47.5*	*147*	*30*	*GAK15*	*4543*
Prince William Sound Stations					
60	7.5	147	50	KIP0	
60	16.7	147	59.2	KIP2	588
60	22.78	147	56.17	PWS1	248
60	32.1	147	48.2	PWS2	798
60	40	147	40	PWS3	742
60	49..25	147	24	PWSA	472
60	45	147	14	PWSB	
60	38.1	147	10	PWSC	245
60	31.5	147	7.6	PWSD	
60	24.3	147	58.3	PWSE	291
60	24	146	45	PWSF	
Columbia Glacier					
61	7.4	147	3.8	CG0	
60	59.5	147	4.2	CG1	192
60	57.6	147	5.9	CG2	
Icy Bay					
60	16.3	148	21.7	IB0	
60	15.5	148	20.1	IB1	172
60	16.3	148	14	IB2	157
Montague Strait Line					
59	57.257	147	55.602	MS1	
59	56.6	147	53.7	MS2	194
59	55.9	147	51.4	MS3	169
59	55.2	147	49.7	MS4	119

Latitude N (degrees, minutes)		Longitude W (degrees, minutes)		Station Name	Depth
Kodiak Line					
58	14.7	151	35.4	KOD1	71
58	7.8	151	23.07	KOD2	127
58	0.9	151	10.74	KOD3	84
57	54	150	58.17	KOD4	78
57	47.1	150	45.6	KOD5	87
57	40.26	150	32.97	KOD6	102
57	33.42	150	20.34	KOD7	178
57	26.37	150	7.95	KOD8	708
57	19.32	149	55.56	KOD9	1310
57	12.27	149	43.17	KOD10	2503
Cape Suckling Line					
59	56.35	143	53.5	CS1	63
59	53.85	143	53.5	CS1.25	85
59	51.35	143	53.5	CS1i	104
59	48.85	143	53.5	CS1.75	116
59	46.35	143	53.5	CS2	124
59	41.35	143	53.5	CS2i	134
59	36.35	143	53.5	CS3	193
59	31.35	143	53.5	CS3i	1316
59	26.35	143	53.5	CS4	2010
59	16.35	143	53.5	CS5	2810
Middleton Island Line					
60	15	145	30	MID1	35
60	10.5	145	34.5	MID1i	100
60	6	145	39	MID2	116
60	1.5	145	43.5	MID2i	98
59	57	145	48	MID3	87
59	52.5	145	52.5	MID3i	100
59	48	145	57	MID4	90
59	43.5	146	1.5	MID4i	72
59	39	146	6	MID5	97
59	34.5	146	10.5	MID5i	114
59	30	146	15	MID6	41
59	25.7	146	10	MID6i	65
59	23	146	18	MID7	65
59	18.267	146	15	MID7i	420
59	13.534	146	12	MID8	611
59	4.067	146	6	MID9	2900
58	54.6	146	0	MID10	4444

Event #	Description	Station	Local	GMT	Latitude	Longitude	Depth	Comments	Scientist
1	CTD 1 Start	Res2.5	4/26/2019 22:45	6:45:03 AM	60.01847	149.3557	300		Danielson
2	CTD 1 End	Res2.5	4/26/2019 23:17	7:17:06 AM	60.01699	149.3534	300		Danielson
3	CTD 2 Start	Gak1	4/27/2019 0:34	8:34:24 AM	59.84467	149.4819	271		Danielson
4	CTD 2 End	Gak1	4/27/2019 0:49	8:49:03 AM	59.84262	149.4843	271		Danielson
5	Bongo 60 cm Start	Mid6	4/27/2019 22:00	6:00:48 AM	59.50004	146.2487	35		Hopcroft
6	Bongo 60 cm Bottom	Mid6	4/27/2019 22:03	6:03:02 AM	59.50149	146.2489	35		Hopcroft
7	Bongo 60 cm End	Mid6	4/27/2019 22:13	6:13:02 AM	59.50503	146.2482	35		Hopcroft
8	Bongo 60 cm Start	Mid5	4/27/2019 23:17	7:17:46 AM	59.65141	146.0999	93		Hopcroft
9	Bongo 60 cm Bottom	Mid5	4/27/2019 23:20	7:20:22 AM	59.65267	146.0986	93		Hopcroft
10	Bongo 60 cm End	Mid5	4/27/2019 23:25	7:25:31 AM	59.65516	146.0963	93		Hopcroft
11	Bongo 60 cm Start	Mid4	4/28/2019 0:36	8:36:43 AM	59.8013	145.9488	90		Hopcroft
12	Bongo 60 cm Bottom	Mid4	4/28/2019 0:39	8:39:32 AM	59.80262	145.9481	90		Hopcroft
13	Bongo 60 cm End	Mid4	4/28/2019 0:46	8:46:22 AM	59.80582	145.9457	90		Hopcroft
14	Bongo 60 cm Start	Mid3	4/28/2019 1:54	9:54:49 AM	59.94942	145.8016	85		Hopcroft
15	Bongo 60 cm Bottom	Mid3	4/28/2019 1:57	9:57:36 AM	59.95064	145.8	85		Hopcroft
16	Bongo 60 cm End	Mid3	4/28/2019 2:06	10:06:06 AM	59.95453	145.7953	85		Hopcroft
17	Bongo 60 cm Start	Mid2	4/28/2019 3:14	11:14:16 AM	60.09978	145.6513	117		Hopcroft
18	Bongo 60 cm End	Mid2	4/28/2019 3:33	11:33:31 AM	60.11502	145.633	117		Hopcroft
19	CTD 03 Start	MID1	4/28/2019 7:33	3:33:25 PM	60.24954	145.5019	17		Danielson
20	CTD 03 End	MID1	4/28/2019 7:44	3:44:28 PM	60.25014	145.5037	17		Danielson
21	Fe Fish Start	MIDa	4/28/2019 7:55	3:55:07 PM	60.23555	145.5232	17		Hopcroft
22	CTD 4 Start	MID1i	4/28/2019 9:00	5:00:35 PM	60.172	145.5836	101	pump didn't start	Danielson
23	CTD 4 Start	MID1i	4/28/2019 9:06	5:06:33 PM	60.1725	145.5848	101		Danielson
24	CTD 4 End	MID1i	4/28/2019 9:14	5:14:16 PM	60.17297	145.5863	101		Danielson
25	CTD 05 Start	MID2	4/28/2019 9:51	5:51:35 PM	60.10168	145.6472	119	prod cast	Strom
26	CTD 05 End	MID2	4/28/2019 10:08	6:08:39 PM	60.10222	145.6504	119		Strom
27	CalVET Net Tow Start	MID2	4/28/2019 10:20	6:20:36 PM	60.10287	145.6531	119		Hopcroft
28	CalVET Net Tow End	MID2	4/28/2019 10:27	6:27:04 PM	60.10326	145.6543	119		Hopcroft
29	CalVET Net Tow Start	MID2	4/28/2019 10:42	6:42:25 PM	60.10376	145.6577	119	genetics	Hopcroft
30	CalVET Net Tow End	MID2	4/28/2019 10:47	6:47:59 PM	60.10397	145.659	119		Hopcroft
31	CTD 06 Start	MID2	4/28/2019 11:15	7:15:49 PM	60.10534	145.6644	119		Danielson
32	CTD 06 End	MID2	4/28/2019 11:30	7:30:56 PM	60.10598	145.6678	119		Danielson
33	CTD 07 Start	MID2i	4/28/2019 12:19	8:19:21 PM	60.02514	145.7266	95		Danielson
34	CTD 07 End	MID2i	4/28/2019 12:27	8:27:04 PM	60.02389	145.7262	95		Danielson
35	CTD 08 Start	MID3	4/28/2019 13:01	9:01:13 PM	59.95138	145.7957	85		Danielson
36	CTD 08 End	MID3	4/28/2019 13:14	9:14:47 PM	59.94925	145.7976	85		Danielson
37	CalVET Net Tow Start	MID3	4/28/2019 13:17	9:17:14 PM	59.94901	145.7976	85		Hopcroft
38	CalVET Net Tow End	MID3	4/28/2019 13:22	9:22:25 PM	59.94858	145.7978	85	hit bottom	Hopcroft
39	CalVET Net Tow Start	MID3	4/28/2019 13:34	9:34:54 PM	59.94788	145.7983	85	recast to 80m	Hopcroft
40	CalVET Net Tow End	MID3	4/28/2019 13:39	9:39:05 PM	59.94772	145.7983	85		Hopcroft
41	CTD 09 Start	MID3i	4/28/2019 14:22	10:22:03 PM	59.87458	145.8766	99		Danielson
42	CTD 09 End	MID3i	4/28/2019 14:36	10:36:23 PM	59.87199	145.8806	99		Danielson
43	CTD 10 Start	MID4	4/28/2019 15:12	11:12:37 PM	59.7997	145.9468	89		Danielson
44	CTD 10 End	MID4	4/28/2019 15:24	11:24:58 PM	59.79932	145.949	89		Danielson
45	CalVET Net Tow Start	MID4	4/28/2019 15:29	11:29:37 PM	59.79954	145.9498	87		Hopcroft

Event #	Description	Station	Local	GMT	Latitude	Longitude	Depth	Comments	Scientist
46	CalVET Net Tow End	MID4	4/28/2019 15:35	11:35:18 PM	59.79987	145.9508	87		Hopcroft
47	CTD 11 Start	MID4i	4/28/2019 16:20	12:20:37 AM	59.72452	146.0251	70		Danielson
48	CTD 11 End	MID4i	4/28/2019 16:28	12:28:31 AM	59.72412	146.0276	70		Danielson
49	CTD 12 Start	MID5	4/28/2019 17:12	1:12:16 AM	59.65178	146.0969	91		Danielson
50	CTD 12 End	MID5	4/28/2019 17:25	1:25:50 AM	59.65108	146.1011	91		Danielson
51	CalVET Net Tow Start	MID5	4/28/2019 17:31	1:31:52 AM	59.65223	146.1025	91		Hopcroft
52	CalVET Net Tow Start	MID5	4/28/2019 17:38	1:38:33 AM	59.65426	146.1027	91		Hopcroft
53	CTD 13 Start	MID5i	4/28/2019 18:57	2:57:18 AM	59.57408	146.1792	111		Danielson
54	CTD 13 End	MID5i	4/28/2019 19:04	3:04:48 AM	59.57388	146.1809	111		Danielson
55	CTD14 Start	MID6	4/28/2019 19:51	3:51:05 AM	59.49945	146.252	40		Danielson
56	CTD14 End	MID6	4/28/2019 19:59	3:59:50 AM	59.50084	146.2526	40		Danielson
57	Fe Fish End	MIDa	4/28/2019 20:01	4:01:23 AM	59.50101	146.2532	40		Aguilar-Islas
58	CalVET Net Tow Start	MID6	4/28/2019 20:04	4:04:43 AM	59.50135	146.2544	40		Hopcroft
59	CalVET Net Tow End	MID6	4/28/2019 20:07	4:07:09 AM	59.50188	146.2557	40		Hopcroft
60	CTD 15 Start	MID6i	4/28/2019 20:52	4:52:26 AM	59.43134	146.168	54		Danielson
61	CTD 15 End	MID6i	4/28/2019 21:12	5:12:48 AM	59.41452	146.2084	54		Danielson
62	Bongo 60 cm Start	MID7	4/28/2019 21:46	5:46:08 AM	59.38418	146.3003	47		Hopcroft
63	Bongo 60 cm Bottom	MID7	4/28/2019 21:48	5:48:14 AM	59.38311	146.2985	47		Hopcroft
64	Bongo 60 cm Bottom	MID7	4/28/2019 21:50	5:50:47 AM	59.38204	146.2969	47		Hopcroft
65	Bongo 60 cm End	MID7	4/28/2019 21:52	5:52:28 AM	59.38141	146.2959	47		Hopcroft
66	Bongo 60 cm Start	MID7i	4/28/2019 22:36	6:36:17 AM	59.30737	146.2528	420		Hopcroft
67	Bongo 60 cm Bottom	MID7i	4/28/2019 22:42	6:42:46 AM	59.30416	146.2512	420		Hopcroft
68	Bongo 60 cm End	MID7i	4/28/2019 22:50	6:50:39 AM	59.30061	146.2487	420		Hopcroft
69	Bongo 60 cm Start	MID8	4/28/2019 23:41	7:41:13 AM	59.22547	146.2016	600		Hopcroft
70	Bongo 60 cm Bottom	MID8	4/28/2019 23:49	7:49:24 AM	59.22034	146.1988	690		Hopcroft
71	Bongo 60 cm End	MID8	4/28/2019 23:55	7:55:52 AM	59.21672	146.1966	690		Hopcroft
72	CTD 16 Start	MS4	4/29/2019 16:13	12:13:39 AM	59.92068	147.8315	114		Danielson
73	CTD 16 End	MS4	4/29/2019 16:22	12:22:26 AM	59.92097	147.8307	114		Danielson
74	CTD 17 Start	MS3	4/29/2019 16:33	12:33:30 AM	59.93194	147.8564	162		Danielson
75	CTD 17 End	MS3	4/29/2019 16:43	12:43:08 AM	59.93316	147.8589	162		Danielson
76	CTD 18 Start	MS1	4/29/2019 17:06	1:06:21 AM	59.95351	147.9266	168		Danielson
77	CTD 18 End	MS1	4/29/2019 17:17	1:17:21 AM	59.95348	147.9249	168		Danielson
78	CTD 19 Start	MS2	4/29/2019 17:31	1:31:32 AM	59.94443	147.8966	191		Danielson
79	CTD 19 End	MS2	4/29/2019 17:51	1:51:11 AM	59.94532	147.8934	191		Danielson
80	CalVET Net Tow Start	MS2	4/29/2019 17:55	1:55:17 AM	59.94478	147.8936	191		Hopcroft
81	CalVET Net Tow End	MS2	4/29/2019 18:03	2:03:19 AM	59.9442	147.8977	191		Hopcroft
82	CTD 20 Start	KIP0	4/29/2019 19:30	3:30:20 AM	60.12432	147.8352	293		Danielson
83	CTD 20 End	KIP0	4/29/2019 19:44	3:44:14 AM	60.12584	147.8341	293		Danielson
84	MultiNet Start	KIP2	4/29/2019 21:22	5:22:12 AM	60.27835	147.9867	575		Hopcroft
85	MultiNet End	KIP2	4/29/2019 21:54	5:54:36 AM	60.29785	147.9771	575		Hopcroft
86	MultiNet Start	PWS1	4/29/2019 22:25	6:25:15 AM	60.35162	147.9528	398		Hopcroft
87	MultiNet End	PWS1	4/29/2019 22:55	6:55:46 AM	60.37096	147.9454	398		Hopcroft
88	MultiNet Start	PWS2	4/30/2019 0:09	8:09:42 AM	60.51796	147.8178	577		Hopcroft
89	MultiNet End	PWS2	4/30/2019 0:44	8:44:40 AM	60.53828	147.7996	577		Hopcroft
90	MultiNet Start	PWS3	4/30/2019 1:37	9:37:52 AM	60.64934	147.6876	7'53		Hopcroft

Event #	Description	Station	Local	GMT	Latitude	Longitude	Depth	Comments	Scientist
91	MultiNet End	PWS3	4/30/2019 2:10	10:10:29 AM	60.66709	147.6693	7'53		Hopcroft
92	MultiNet Start	PWSA	4/30/2019 3:23	11:23:59 AM	60.80454	147.4229	448		Hopcroft
93	MultiNet End	PWSA	4/30/2019 4:00	12:00:43 PM	60.82215	147.396	448		Hopcroft
94	CalVET Net Tow Start	PWSA	4/30/2019 6:02	2:02:09 PM	60.82375	147.3926	448	cv7	Hopcroft
95	CalVET Net Tow End	PWSA	4/30/2019 6:08	2:08:39 PM	60.82462	147.3928	448		Hopcroft
96	CTD 21 Start	PWSA	4/30/2019 6:15	2:15:45 PM	60.82544	147.3929	462		Danielson
97	CTD 21 End	PWSA	4/30/2019 6:49	2:49:54 PM	60.82891	147.3938	462		Danielson
98	CTD 22 Start	PWS3	4/30/2019 8:14	4:14:53 PM	60.66837	147.6698	740		Danielson
99	CTD 22 End	PWS3	4/30/2019 8:55	4:55:12 PM	60.66555	147.6699	740		Danielson
100	CalVET Net Tow Start	PWS3	4/30/2019 8:56	4:56:12 PM	60.66555	147.6699	740		Hopcroft
101	CalVET Net Tow End	PWS3	4/30/2019 9:02	5:02:44 PM	60.6649	147.6698	740		Hopcroft
102	Fe fish start		4/30/2019 9:07						Aguilar-Islas
103	CTD 23 Start	PWS2	4/30/2019 10:18	6:18:42 PM	60.53623	147.8031	738	prod	Strom
104	CTD 23 End	PWS2	4/30/2019 10:38	6:38:22 PM	60.54048	147.802	738		Strom
105	CalVET Net Tow Start	PWS2	4/30/2019 10:41	6:41:28 PM	60.54068	147.8021	738		Hopcroft
106	CalVET Net Tow End	PWS2	4/30/2019 10:46	6:46:55 PM	60.54102	147.8018	738		Hopcroft
107	CalVET Net Tow Start	PWS2	4/30/2019 10:59	6:59:38 PM	60.53677	147.803	738	genetics	Hopcroft
108	CalVET Net Tow End	PWS2	4/30/2019 11:05	7:05:06 PM	60.53737	147.803	738		Hopcroft
109	CTD 24 Start	PWS2	4/30/2019 11:27	7:27:50 PM	60.5347	147.7985	734		Danielson
110	CTD 24 End	PWS2	4/30/2019 12:07	8:07:40 PM	60.53935	147.7889	734		Danielson
111	MultiNet Start	PWS2	4/30/2019 12:45	8:45:24 PM	60.53688	147.7943	734	vertical deep	Hopcroft
112	MultiNet End	PWS2	4/30/2019 13:27	9:27:50 PM	60.53989	147.7862	734	late position -time corrected	Hopcroft
113	MultiNet Start	PWS2	4/30/2019 13:55	9:55:10 PM	60.53069	147.8118	734	vertical shallow	Hopcroft
114	MultiNet End	PWS2	4/30/2019 14:17	10:17:28 PM	60.53078	147.8058	734		Hopcroft
115	Fe fish end		4/30/2019 15:20						
116	CTD 25 Start	PWS1	4/30/2019 15:31	11:31:18 PM	60.37128	147.9435	336		Danielson
117	CTD 25 End	PWS1	4/30/2019 15:59	11:59:12 PM	60.36834	147.9466	336		Danielson
118	CalVET Net Tow Start	PWS1	4/30/2019 16:02	12:02:14 AM	60.36799	147.9469	336		Hopcroft
119	CalVET Net Tow End	PWS1	4/30/2019 16:09	12:09:44 AM	60.3672	147.9477	336		Hopcroft
120	CTD 26 Start	KIP2	4/30/2019 16:47	12:47:15 AM	60.27861	147.9861	590		Danielson
121	CTD 26 End	KIP2	4/30/2019 17:23	1:23:34 AM	60.27246	147.9859	590		Danielson
122	CalVET Net Tow Start	KIP2	4/30/2019 17:27	1:27:41 AM	60.2716	147.9858			Hopcroft
123	CalVET Net Tow End	KIP2	4/30/2019 17:33	1:33:44 AM	60.27069	147.986			Hopcroft
124	CTD 27 Start	IB2	4/30/2019 18:48	2:48:40 AM	60.27514	148.2299	156		Danielson
125	CTD 27 End	IB2	4/30/2019 18:57	2:57:34 AM	60.27496	148.2267	156		Danielson
126	CalVET Net Tow Start	IB2	4/30/2019 19:01	3:01:14 AM	60.27512	148.2255	156		Hopcroft
127	CalVET Net Tow End	IB2	4/30/2019 19:06	3:06:54 AM	60.27542	148.2238	156		Hopcroft
128	CTD 28 Start	IB1	4/30/2019 19:39	3:39:15 AM	60.24255	148.3351	168		Danielson
129	CTD 28 End	IB1	4/30/2019 19:54	3:54:54 AM	60.24269	148.3373	168		Danielson
130	CalVET Net Tow Start	IB1	4/30/2019 19:58	3:58:57 AM	60.24244	148.3366	168		Hopcroft
131	CalVET Net Tow End	IB1	4/30/2019 20:04	4:04:23 AM	60.24228	148.3361	168		Hopcroft
132	CTD 29 Start	IB0	4/30/2019 20:43	4:43:01 AM	60.2657	148.3615	330		Danielson
133	CTD 29 End	IB0	4/30/2019 21:08	5:08:03 AM	60.26565	148.3581	330		Danielson
134	CalVET Net Tow Start	IB0	4/30/2019 21:12	5:12:34 AM	60.26551	148.3577	330		Hopcroft
135	CalVET Net Tow End	IB0	4/30/2019 21:18	5:18:20 AM	60.26542	148.3573	330		Hopcroft

Event #	Description	Station	Local	GMT	Latitude	Longitude	Depth	Comments	Scientist
136	MultiNet Start	GAK1	5/1/2019 5:10	1:10:55 PM	59.82988	149.4564	273	MULTI 6	Coyle
137	MultiNet End	GAK1	5/1/2019 5:43	1:43:55 PM	59.84581	149.4832	273		Coyle
138	Bongo 60 cm Start	GAK1	5/1/2019 6:12	2:12:26 PM	59.84173	149.4796	270		Coyle
139	Bongo 60 cm Bottom	GAK1	5/1/2019 6:20	2:20:52 PM	59.83919	149.4674	270		Coyle
140	Bongo 60 cm End	GAK1	5/1/2019 6:29	2:29:02 PM	59.83698	149.4568	270		Coyle
141	MultiNet Start	GAK1	5/1/2019 7:07	3:07:55 PM	59.84442	149.4836	270	vertical shallow	Hopcroft
142	MultiNet End	GAK1							Hopcroft
143	CTD 30 Start	GAK1	5/1/2019 7:54	3:54:13 PM	59.84631	149.485	270		Danielson
144	CTD 30 End	GAK1	5/1/2019 8:09	4:09:56 PM	59.84593	149.4869	270		Danielson
145	CalVET Net Tow Start	GAK1	5/1/2019 8:17	4:17:08 PM	59.84617	149.4878	270		Hopcroft
146	CalVET Net Tow End	GAK1	5/1/2019 8:22	4:22:45 PM	59.84663	149.4877	270		Hopcroft
147	CalVET Net Tow Start	GAK1	5/1/2019 8:38	4:38:38 PM	59.84809	149.4866	270	GENETICS	Hopcroft
148	CalVET Net Tow End	GAK1	5/1/2019 8:43	4:43:59 PM	59.84874	149.487	270		Hopcroft
149	CTD 31 Start	GAK1	5/1/2019 8:49	4:49:01 PM	59.84486	149.4838	270		Danielson
150	CTD 31 End	GAK1	5/1/2019 9:05	5:05:07 PM	59.84303	149.4841	270		Danielson
151	CTD 32 Start	GAK1	5/1/2019 9:51	5:51:46 PM	59.84416	149.4816	270	prod	Strom
152	CTD 32 End	GAK1	5/1/2019 10:12	6:12:59 PM	59.84573	149.4839	270		Strom
153	Fe Fish start		5/1/2019 10:20						Aguilar-Islas
154	CTD 33 Start	GAK1i	5/1/2019 11:00	7:00:57 PM	59.7688	149.403	265		Danielson
155	CTD 33 End	GAK1i	5/1/2019 11:11	7:11:29 PM	59.76867	149.4053	265		Danielson
156	CTD 34 Start	GAK2	5/1/2019 11:53	7:53:44 PM	59.693	149.33	230		Danielson
157	CTD 34 End	GAK2	5/1/2019 12:10	8:10:14 PM	59.69381	149.3272	230		Danielson
158	CalVET Net Tow Start	GAK2	5/1/2019 12:13	8:13:24 PM	59.69413	149.3266			Hopcroft
159	CalVET Net Tow End	GAK2	5/1/2019 12:18	8:18:39 PM	59.69464	149.3272			Hopcroft
160	CTD 35 Start	GAK2i	5/1/2019 13:00	9:00:36 PM	59.62495	149.2577	215		Danielson
161	CTD 35 End	GAK2i	5/1/2019 13:13	9:13:14 PM	59.62264	149.251	215		Danielson
162	CTD 36 Start	GAK3	5/1/2019 13:47	9:47:55 PM	59.55211	149.1874	215		Danielson
163	CTD 36 End	GAK3	5/1/2019 14:07	10:07:19 PM	59.54449	149.1855	215		Danielson
164	CalVET Net Tow Start	GAK3	5/1/2019 14:10	10:10:59 PM	59.54299	149.1855	215		Hopcroft
165	CalVET Net Tow End	GAK3	5/1/2019 14:16	10:16:34 PM	59.54183	149.1844	215		Hopcroft
166	CTD 37 Start	GAK3i	5/1/2019 14:58	10:58:03 PM	59.48228	149.1231	204		Danielson
167	CTD 37 End	GAK3i	5/1/2019 15:07	11:07:29 PM	59.48085	149.126	204		Danielson
168	CTD 38 Start	GAK4	5/1/2019 15:50	11:50:23 PM	59.40863	149.0478	199		Danielson
169	CTD 38 End	GAK4	5/1/2019 16:07	12:07:50 AM	59.4056	149.0518	199		Danielson
170	CalVET Net Tow Start	GAK4	5/1/2019 16:13	12:13:04 AM	59.40454	149.0527	199		Hopcroft
171	CalVET Net Tow End	GAK4	5/1/2019 16:19	12:19:19 AM	59.40484	149.0533	199		Hopcroft
172	CTD 39 Start	GAK4i	5/1/2019 17:01	1:01:22 AM	59.33438	148.9975	193		Danielson
173	Fe Fish End	GAK4i	5/1/2019 17:02	1:02:17 AM	59.33409	148.9975	193		Aguilar-Islas
174	CTD 39 end	GAK4i	5/1/2019 0:00						Danielson
175	Bongo 60 cm Start	GAK3	5/1/2019 19:11	3:11:55 AM	59.55275	149.1886	213		Hopcroft
176	Bongo 60 cm Bottom	GAK3	5/1/2019 19:20	3:20:50 AM	59.55894	149.1834	213		Hopcroft
177	Bongo 60 cm End	GAK3	5/1/2019 19:28	3:28:33 AM	59.56345	149.1793	213	Flowmeters spun in the wind	Hopcroft
178	Bongo 60 cm Start	GAK2	5/1/2019 20:31	4:31:57 AM	59.68209	149.322	223		Hopcroft
179	Bongo 60 cm Bottom	GAK2	5/1/2019 20:42	4:42:34 AM	59.69268	149.3237	223		Hopcroft
180	Bongo 60 cm End	GAK2	5/1/2019 20:52	4:52:51 AM	59.69965	149.324	223		Hopcroft

Event #	Description	Station	Local	GMT	Latitude	Longitude	Depth	Comments	Scientist
181	MultiNet Start	GAK2	5/1/2019 21:43	5:43:46 AM	59.70195	149.3338	223		Hopcroft
182	MultiNet End	GAK2	5/1/2019 22:18	6:18:29 AM	59.68327	149.3134	223		Hopcroft
183	MultiNet Start	GAK3	5/1/2019 23:13	7:13:32 AM	59.56753	149.2002	214		Hopcroft
184	MultiNet End	GAK3	5/1/2019 23:42	7:42:56 AM	59.54748	149.19	214		Hopcroft
185	MultiNet Start	GAK4	5/2/2019 0:42	8:42:43 AM	59.42956	149.0665	202		Hopcroft
186	MultiNet End	GAK4	5/2/2019 1:20	9:20:05 AM	59.40993	149.06	202		Hopcroft
187	Bongo 60 cm Start	GAK4	5/2/2019 1:41	9:41:28 AM	59.39786	149.0549	202		Hopcroft
188	Bongo 60 cm Bottom	GAK4	5/2/2019 1:46	9:46:33 AM	59.39524	149.0537	204		Hopcroft
189	Bongo 60 cm End	GAK4	5/2/2019 1:52	9:52:33 AM	59.39232	149.0521	204		Hopcroft
190	MultiNet Start	GAK5	5/2/2019 2:59	10:59:02 AM	59.26546	148.9398	181		Hopcroft
191	MultiNet End	GAK5	5/2/2019 3:31	11:31:38 AM	59.24488	148.935	181		Hopcroft
192	MultiNet Start	GAK6	5/2/2019 4:30	12:30:46 PM	59.13854	148.7737	142		Hopcroft
193	MultiNet End	GAK6	5/2/2019 5:04	1:04:39 PM	59.11856	148.7663	142		Hopcroft
194	Bongo 60 cm Start	GAK6	5/2/2019 5:24	1:24:01 PM	59.1073	148.7642	153		Hopcroft
195	Bongo 60 cm Bottom	GAK6	5/2/2019 5:29	1:29:11 PM	59.10484	148.763	153		Hopcroft
196	Bongo 60 cm End	GAK6	5/2/2019 5:35	1:35:17 PM	59.10106	148.761	153		Hopcroft
197	Bongo 60 cm Start	GAK5	5/2/2019 6:42	2:42:48 PM	59.23486	148.9185	161		Hopcroft
198	Bongo 60 cm Bottom	GAK5	5/2/2019 6:48	2:48:02 PM	59.23917	148.916	161		Hopcroft
199	Bongo 60 cm End	GAK5	5/2/2019 6:53	2:53:28 PM	59.24289	148.9136	161		Hopcroft
200	MultiNet Start	GAK5	5/2/2019 7:37	3:37:21 PM	59.24393	148.93	168	vertical shallow	Hopcroft
201	MultiNet End	GAK5	5/2/2019 7:52	3:52:48 PM	59.24228	148.9315	168	hit bottom	Hopcroft
202	CTD 40 Start	GAK5	5/2/2019 8:16	4:16:07 PM	59.24329	148.93	167		Danielson
203	CTD 40 End	GAK5	5/2/2019 8:33	4:33:27 PM	59.24201	148.9333	167		Danielson
204	CalVET Net Tow Start	GAK5	5/2/2019 8:36	4:36:51 PM	59.24222	148.9326	167		Hopcroft
205	CalVET Net Tow End	GAK5	5/2/2019 8:42	4:42:48 PM	59.24293	148.9325	167		Hopcroft
206	CalVET Net Tow Start	GAK5	5/2/2019 8:56	4:56:24 PM	59.24436	148.9289	167	gen	Hopcroft
207	CalVET Net Tow End	GAK5	5/2/2019 9:01	5:01:51 PM	59.24457	148.9282	167		Hopcroft
208	CTD 41 Start	GAK5	5/2/2019 9:49	5:49:23 PM	59.24375	148.9304	168	prod	Strom
209	CTD 41 End	GAK5	5/2/2019 10:05	6:05:33 PM	59.24497	148.9329	168		Strom
210	Fe fish start		5/2/2019 10:20						Aguilar-Islas
211	CTD 42 Start	GAK5i	5/2/2019 11:01	7:01:06 PM	59.17238	148.8451	174		Danielson
212	CTD 42 End	GAK5i	5/2/2019 11:09	7:09:14 PM	59.17319	148.8455	174		Danielson
213	CTD 43 Start	GAK6	5/2/2019 11:49	7:49:46 PM	59.11882	148.7664	151		Danielson
214	CTD 43 End	GAK6	5/2/2019 12:03	8:03:49 PM	59.11906	148.7653	151		Danielson
215	CalVET Net Tow Start	GAK6	5/2/2019 12:07	8:07:59 PM	59.11958	148.7639	151		Hopcroft
216	CalVET Net Tow End	GAK6	5/2/2019 12:14	8:14:13 PM	59.12039	148.7617	151		Hopcroft
217	CTD 44 Start	GAK6i	5/2/2019 12:56	8:56:19 PM	59.04532	148.701	193		Danielson
218	CTD 44 End	GAK6i	5/2/2019 13:05	9:05:45 PM	59.04578	148.7023	193		Danielson
219	CTD 45 Start	GAK7	5/2/2019 13:48	9:48:33 PM	58.9734	148.6352	240		Danielson
220	CTD 45 End	GAK7	5/2/2019 14:07	10:07:15 PM	58.97356	148.6311	240		Danielson
221	CalVET Net Tow Start	GAK7	5/2/2019 14:09	10:09:43 PM	58.97401	148.6302	240		Hopcroft
222	CalVET Net Tow End	GAK7	5/2/2019 14:15	10:15:11 PM	58.97451	148.6281	240		Hopcroft
223	CTD 46 Start	GAK7i	5/2/2019 15:03	11:03:51 PM	58.88702	148.5596	300		Danielson
224	CTD 46 End	GAK7i	5/2/2019 15:18	11:18:58 PM	58.88476	148.5573	300		Danielson
225	CTD 47 Start	GAK8	5/2/2019 15:55	11:55:21 PM	58.80888	148.4948	291		Danielson

Event #	Description	Station	Local	GMT	Latitude	Longitude	Depth	Comments	Scientist
226	CTD 47 End	GAK8	5/2/2019 16:16	12:16:53 AM	58.80474	148.489	291		Danielson
227	CalVET Net Tow Start	GAK8	5/2/2019 16:20	12:20:17 AM	58.80418	148.487	291		Hopcroft
228	CalVET Net Tow End	GAK8	5/2/2019 16:27	12:27:09 AM	58.80285	148.4846	291		Hopcroft
229	CTD 48 Start	GAK8i	5/2/2019 17:05	1:05:21 AM	58.7426	148.4181	289		Danielson
230	CTD 48 End	GAK8i	5/2/2019 17:17	1:17:19 AM	58.73961	148.4142	289		Danielson
231	Bongo 60 cm Start	GAK9	5/2/2019 18:19	2:19:51 AM	58.66564	148.3494	273		Hopcroft
232	Bongo 60 cm Bottom	GAK9	5/2/2019 18:29	2:29:53 AM	58.67369	148.3445	273		Hopcroft
233	Bongo 60 cm End	GAK9	5/2/2019 18:40	2:40:19 AM	58.68062	148.3429	273		Hopcroft
234	Bongo 60 cm Start	GAK8	5/2/2019 19:46	3:46:57 AM	58.80001	148.501	291		Coyle
235	Bongo 60 cm Bottom	GAK8	5/2/2019 19:57	3:57:23 AM	58.8074	148.4902	291		Coyle
236	Bongo 60 cm End	GAK8	5/2/2019 20:11	4:11:26 AM	58.81613	148.4773	291		Coyle
237	Bongo 60 cm Start	GAK7	5/2/2019 21:26	5:26:20 AM	58.95388	148.6383	258		Coyle
238	Bongo 60 cm Bottom	GAK7	5/2/2019 21:36	5:36:25 AM	58.96347	148.6325	258		Coyle
239	Bongo 60 cm End	GAK7	5/2/2019 21:47	5:47:17 AM	58.96962	148.6294	258		Coyle
240	MultiNet Start	GAK7	5/2/2019 22:07	6:07:19 AM	58.98226	148.6189	240		Coyle
241	MultiNet End	GAK7	5/2/2019 22:46	6:46:58 AM	58.96409	148.6388	240		Coyle
242	MultiNet Start	GAK8	5/3/2019 0:00	8:00:41 AM	58.82574	148.5118	296		Coyle
243	MultiNet End	GAK8	5/3/2019 0:39	8:39:25 AM	58.81165	148.5457	296		Coyle
244	MultiNet Start	GAK9	5/3/2019 1:57	9:57:37 AM	58.68344	148.315	286		Coyle
245	MultiNet End	GAK9	5/3/2019 2:32	10:32:12 AM	58.68021	148.3476	286		Coyle
246	MultiNet Start	GAK10	5/3/2019 3:46	11:45:58 AM	58.5417	148.1635	1500		Coyle
247	MultiNet End	GAK10	5/3/2019 4:23	12:23:11 PM	58.53821	148.1978	1500		Coyle
248	MultiNet Start	GAK11	5/4/2019 0:27	8:27:38 AM	58.38563	148.021	1500		Coyle
249	MultiNet End	GAK11	5/4/2019 1:10	9:10:29 AM	58.36479	148.0496	1500		Coyle
250	Bongo 60 cm Start	GAK11	5/4/2019 1:49	9:49:39 AM	58.37611	148.071	1500		Coyle
251	Bongo 60 cm Bottom	GAK11	5/4/2019 1:57	9:57:28 AM	58.3716	148.0772	1500		Coyle
252	Bongo 60 cm End	GAK11	5/4/2019 2:03	10:03:44 AM	58.36767	148.0807	1500		Coyle
253	Bongo 60 cm Start	GAK10	5/4/2019 3:18	11:18:47 AM	58.52099	148.202	1500		Coyle
254	Bongo 60 cm Bottom	GAK10	5/4/2019 3:25	11:25:46 AM	58.51771	148.2079	1500		Coyle
255	Bongo 60 cm End	GAK10	5/4/2019 3:31	11:31:40 AM	58.51518	148.2121	1500		Coyle
256	MultiNet Start	GAK9	5/4/2019 7:42	3:42:25 PM	58.67463	148.346	277	vertical	Coyle
257	MultiNet End	GAK9	5/4/2019 8:12	4:12:11 PM	58.66852	148.3364	277		Coyle
258	CTD 49 Start	GAK9	5/4/2019 8:25	4:25:08 PM	58.67798	148.3492	277		Danielson
259	CTD 49 End	GAK9	5/4/2019 8:45	4:45:12 PM	58.67289	148.3447	277		Danielson
260	CalVET Net Tow Start	GAK9	5/4/2019 8:53	4:53:11 PM	58.67485	148.3497	277		Hopcroft
261	CalVET Net Tow End	GAK9	5/4/2019 8:58	4:58:34 PM	58.67321	148.3486	277		Hopcroft
262	CalVET Net Tow Start	GAK9	5/4/2019 9:20	5:20:47 PM	58.66812	148.3428	277	jen	Hopcroft
263	CalVET Net Tow End	GAK9	5/4/2019 9:26	5:26:28 PM	58.66703	148.3413	277		Hopcroft
264	CTD 50 Start	GAK9	5/4/2019 9:40	5:40:50 PM	58.67585	148.3483	277	prod	Strom
265	CTD 50 End	GAK9	5/4/2019 9:48	5:48:28 PM	58.67407	148.3488	277		Strom
266	Fe Fish Start	GAK9	5/4/2019 10:01	6:01:29 PM	58.65784	148.3314	277		Aguilar-Islas
267	CTD 51 Start	GAK9i	5/4/2019 10:29	6:29:01 PM	58.6105	148.2779	689		Danielson
268	CTD 51 End	GAK9i	5/4/2019 10:51	6:51:57 PM	58.60872	148.276	689		Danielson
269	CTD 52 Start	GAK10	5/4/2019 11:37	7:37:10 PM	58.53008	148.2032	1459		Danielson
270	CTD 52 End	GAK10	5/4/2019 12:20	8:20:38 PM	58.52679	148.2087	1459		Danielson

Event #	Description	Station	Local	GMT	Latitude	Longitude	Depth	Comments	Scientist
271	CalVET Net Tow Start	GAK10	5/4/2019 12:24	8:24:11 PM	58.52625	148.2094	1459		Hopcroft
272	CalVET Net Tow End	GAK10	5/4/2019 12:29	8:29:43 PM	58.52582	148.2103	1459		Hopcroft
273	CTD 53 Start	GAK11	5/4/2019 13:42	9:42:24 PM	58.38796	148.0735	2134		Danielson
274	CTD 53 End	GAK11	5/4/2019 14:25	10:25:11 PM	58.38147	148.0814	2134		Danielson
275	CalVET Net Tow Start	GAK11	5/4/2019 14:29	10:29:50 PM	58.38098	148.0819	2134		Hopcroft
276	CalVET Net Tow End	GAK11	5/4/2019 14:36	10:36:37 PM	58.38099	148.0821	2134		Hopcroft
277	CTD 54 Start	GAK12	5/4/2019 15:48	11:48:52 PM	58.24145	147.9265	2058		Danielson
278	CTD 54 End	GAK12	5/4/2019 16:34	12:34:20 AM	58.24185	147.9402	2058		Danielson
279	CalVET Net Tow Start	GAK12	5/4/2019 16:37	12:37:26 AM	58.24182	147.9409	2058		Hopcroft
280	CalVET Net Tow End	GAK12	5/4/2019 16:43	12:43:30 AM	58.24211	147.9412	2058		Hopcroft
281	CTD 55 Start	GAK13	5/4/2019 17:57	1:57:25 AM	58.09679	147.7831	2058		Danielson
282	CTD 55 End	GAK13	5/4/2019 18:42	2:42:10 AM	58.09267	147.7863	2058		Danielson
283	CalVET Net Tow Start	GAK13	5/4/2019 18:45	2:45:47 AM	58.09255	147.7855	2058		Hopcroft
284	CalVET Net Tow End	GAK13	5/4/2019 18:53	2:53:22 AM	58.09247	147.7841	2058		Hopcroft
285	CTD 56 Start	GAK14	5/4/2019 20:06	4:06:35 AM	57.94285	147.6474	3518		Danielson
286	CTD 56 End	GAK14	5/4/2019 20:46	4:46:49 AM	57.94315	147.6407	3518		Danielson
287	CalVET Net Tow Start	GAK14	5/4/2019 20:49	4:49:26 AM	57.94296	147.6408	3518		Hopcroft
288	CalVET Net Tow End	GAK14	5/4/2019 20:55	4:55:53 AM	57.94333	147.6392	3518		Hopcroft
289	Fe Fish End	GAK15	5/4/2019 22:17	6:17:04 AM	57.79017	147.4995	4543		Aguilar-Islas
290	CalVET Net Tow Start	GAK15	5/4/2019 22:24	6:24:00 AM	57.79057	147.5015	4543		Hopcroft
291	CalVET Net Tow End	GAK15	5/4/2019 22:29	6:29:34 AM	57.79124	147.5012	4543		Hopcroft
292	CTD 57 Start	GAK15	5/4/2019 22:34	6:34:43 AM	57.79181	147.5019	4543		Danielson
293	CTD 57 End	GAK15	5/4/2019 23:17	7:17:25 AM	57.79816	147.5054	4543		Danielson
294	MultiNet Start	GAK15	5/4/2019 23:37	7:37:18 AM	57.79557	147.504	4543		Hopcroft
295	MultiNet End	GAK15	5/5/2019 0:06	8:06:13 AM	57.77906	147.4753	4543		Hopcroft
296	MultiNet Start	GAK14	5/5/2019 1:20	9:20:41 AM	57.92781	147.6327	3518		Hopcroft
297	MultiNet End	GAK14	5/5/2019 1:56	9:56:19 AM	57.94841	147.6453	3518		Hopcroft
298	MultiNet Start	GAK13	5/5/2019 2:59	10:59:26 AM	58.08133	147.7707	2058		Hopcroft
299	MultiNet End	GAK13	5/5/2019 3:32	11:32:01 AM	58.09874	147.7851	2058		Hopcroft
300	MultiNet Start	GAK12	5/5/2019 4:32	12:32:11 PM	58.22699	147.9135	2058		Hopcroft
301	MultiNet End	GAK12	5/5/2019 5:11	1:11:00 PM	58.24826	147.9357	2058		Hopcroft
302	Bongo 60 cm Start	GAK12	5/5/2019 5:34	1:34:50 PM	58.24489	147.9309	2058		Hopcroft
303	Bongo 60 cm Bottom	GAK12	5/5/2019 5:42	1:42:19 PM	58.24166	147.9254	2058		Hopcroft
304	Bongo 60 cm End	GAK12	5/5/2019 5:48	1:48:14 PM	58.2392	147.9211	2058		Hopcroft
305	Bongo 60 cm Start	GAK13	5/5/2019 6:54	2:54:13 PM	58.09824	147.7873	2058		Hopcroft
306	Bongo 60 cm Bottom	GAK13	5/5/2019 7:01	3:01:17 PM	58.09355	147.7814	2058		Hopcroft
307	Bongo 60 cm End	GAK13	5/5/2019 7:09	3:09:05 PM	58.08899	147.7732	2058		Hopcroft
308	Bongo 60 cm Start	GAK14	5/5/2019 8:17	4:17:42 PM	57.94417	147.6494	3518		Hopcroft
309	Bongo 60 cm Bottom	GAK14	5/5/2019 8:25	4:25:08 PM	57.93998	147.6411	3518		Hopcroft
310	Bongo 60 cm End	GAK14	5/5/2019 8:32	4:32:23 PM	57.93712	147.6357	3518		Hopcroft
311	Bongo 60 cm Start	GAK15	5/5/2019 9:46	5:46:38 PM	57.7911	147.5016	4543		Hopcroft
312	Bongo 60 cm Bottom	GAK15	5/5/2019 9:53	5:53:10 PM	57.7882	147.4964	4543		Hopcroft
313	Bongo 60 cm End	GAK15	5/5/2019 9:58	5:58:59 PM	57.78683	147.4928	4543		Hopcroft
314	CTD 58 Start	GAK15	5/5/2019 10:21	6:21:25 PM	57.79296	147.4974	4543	prod	Strom
315	CTD 58 End	GAK15	5/5/2019 10:39	6:39:18 PM	57.79495	147.4995	4543		Strom

Event #	Description	Station	Local	GMT	Latitude	Longitude	Depth	Comments	Scientist
316	MultiNet Start	GAK15	5/5/2019 11:05				4543	vertical deep	Hopcroft
317	MultiNet End	GAK15					4543		Hopcroft
318	MultiNet Start	GAK15	5/5/2019 12:36	8:36:41 PM	57.79354	147.5034	4543	shallow	Hopcroft
319	MultiNet End	GAK15	5/5/2019 12:49	8:49:31 PM	57.79216	147.4992	4543		Hopcroft
320	CalVET Net Tow Start	GAK15	5/5/2019 12:58	8:58:12 PM	57.79439	147.5001	4543	GENETICS	Hopcroft
321	CalVET Net Tow End	GAK15	5/5/2019 13:15	9:15:13 PM	57.79932	147.5037	4543		Hopcroft
322	CalVET Net Tow Start	GAK15	5/5/2019 13:18	9:18:50 PM	57.79988	147.5028	4543		Hopcroft
323	CalVET Net Tow End	GAK15	5/5/2019 13:24	9:24:15 PM	57.80062	147.5022	4543		Hopcroft
324	Fe Fish Start	GAK15	5/5/2019 13:24	9:24:51 PM	57.8005	147.5021	4543		Aguilar-Islas
325	Fe Fish End	GAK15	5/5/2019 15:13	11:13:18 PM	57.76625	147.8981	4543		Aguilar-Islas
326	Bongo 60 cm Start	KOD7	5/5/2019 23:53	7:53:26 AM	57.5591	150.3377	181		Hopcroft
327	Bongo 60 cm Bottom	KOD7	5/5/2019 23:59	7:59:27 AM	57.55559	150.3409	181		Hopcroft
328	Bongo 60 cm End	KOD7	5/6/2019 0:04	8:04:08 AM	57.55322	150.3431	181		Hopcroft
329	Bongo 60 cm Start	KOD8	5/6/2019 1:15	9:15:30 AM	57.44068	150.1342	720		Hopcroft
330	Bongo 60 cm Bottom	KOD8	5/6/2019 1:22	9:22:13 AM	57.43643	150.1353	720		Hopcroft
331	Bongo 60 cm End	KOD8	5/6/2019 1:27	9:27:57 AM	57.43327	150.1362	720		Hopcroft
332	Bongo 60 cm Start	KOD9	5/6/2019 2:38	10:38:08 AM	57.32365	149.9276	1500		Hopcroft
333	Bongo 60 cm Bottom	KOD9	5/6/2019 2:46	10:46:24 AM	57.31829	149.9266	1500	Bottom depth out of range	Hopcroft
334	Bongo 60 cm End	KOD9	5/6/2019 2:53	10:53:46 AM	57.31417	149.9259	1500		Hopcroft
335	Bongo 60 cm Start	KOD10	5/6/2019 4:00	12:00:08 PM	57.20527	149.7198	1500	Bottom depth out of range	Hopcroft
336	Bongo 60 cm Bottom	KOD10	5/6/2019 4:09	12:09:30 PM	57.19927	149.7171	1500		Hopcroft
337	Bongo 60 cm End	KOD10	5/6/2019 4:17	12:17:44 PM	57.1949	149.715	1500		Hopcroft
338	Bongo 60 cm Start	KOD11	5/6/2019 5:25	1:25:34 PM	57.08439	149.5072	1500	Bottom depth out of range	Hopcroft
339	Bongo 60 cm Bottom	KOD11	5/6/2019 5:34	1:34:46 PM	57.07878	149.5042	1500		Hopcroft
340	Bongo 60 cm End	KOD11	5/6/2019 5:42	1:42:54 PM	57.07436	149.502	1500		Hopcroft
341	Bongo 60 cm Start	KOD12	5/6/2019 6:47	2:47:25 PM	56.96868	149.302	1500	Bottom depth out of range	Hopcroft
342	Bongo 60 cm Bottom	KOD12	5/6/2019 6:56	2:56:00 PM	56.96199	149.3018	1500		Hopcroft
343	Bongo 60 cm End	KOD12	5/6/2019 7:04	3:04:45 PM	56.95706	149.3048	1500		Hopcroft
344	CTD 59 Start	KOD12	5/6/2019 7:40	3:40:38 PM	56.96814	149.2919	5000		Danielson
345	CTD 59 End	KOD12	5/6/2019 8:32	4:32:04 PM	56.96678	149.2992	5000		Danielson
346	CalVET Net Tow Start	KOD12	5/6/2019 8:35	4:35:37 PM	56.96719	149.2995	5000		Hopcroft
347	CalVET Net Tow End	KOD12	5/6/2019 8:41	4:41:09 PM	56.96742	149.3006	5000		Hopcroft
348	CTD 60 Start	KOD11	5/6/2019 9:55	5:55:00 PM	57.08744	149.5081	2750		Danielson
349	CTD 60 End	KOD11	5/6/2019 10:45				2750		Danielson
350	CalVET Net Tow Start	KOD11	5/6/2019 10:46	6:46:09 PM	57.0918	149.5069	2750		Hopcroft
351	CalVET Net Tow End	KOD11	5/6/2019 10:51	6:51:41 PM	57.09279	149.5071	2750		Hopcroft
352	CTD 61 Start	KOD10	5/6/2019 12:03	8:03:32 PM	57.20387	149.7156	2503	prod	Strom
353	CTD 61 End	KOD10	5/6/2019 12:17	8:17:54 PM	57.20712	149.7116	2503		Strom
354	CalVET Net Tow Start	KOD10	5/6/2019 12:21	8:21:51 PM	57.20814	149.7108	2503		Hopcroft
355	CalVET Net Tow End	KOD10	5/6/2019 12:27	8:27:41 PM	57.20956	149.7092	2503		Hopcroft
356	CalVET Net Tow Start	KOD10	5/6/2019 12:44	8:44:23 PM	57.20747	149.7063	2503	gen	Hopcroft
357	CalVET Net Tow End	KOD10	5/6/2019 12:49	8:49:53 PM	57.20855	149.705	2503		Hopcroft
358	CTD 62 Start	KOD10	5/6/2019 13:02	9:02:14 PM	57.20955	149.701	2503		Danielson
359	CTD 62 End	KOD10	5/6/2019 13:46	9:46:07 PM	57.21451	149.6914	2503		Danielson
360	CTD 63 Start	KOD9	5/6/2019 14:58	10:58:49 PM	57.32077	149.9175	1310		Danielson

361	CTD 63 End	KOD9	5/6/2019 15:45	11:45:30 PM	57.31667	149.9113	1310		Danielson
362	CalVET Net Tow Start	KOD9	5/6/2019 15:49	11:49:17 PM	57.3165	149.9108	1310		Hopcroft
363	CalVET Net Tow End	KOD9	5/6/2019 15:55	11:55:18 PM	57.31682	149.9102	1310		Hopcroft
364	CTD 64 Start	KOD8	5/6/2019 17:09	1:09:42 AM	57.44219	150.1357	719		Danielson
365	CTD 64 End	KOD8	5/6/2019 17:43	1:43:56 AM	57.44173	150.1256	719		Danielson
366	CalVET Net Tow Start	KOD8	5/6/2019 17:47	1:47:51 AM	57.44156	150.1249	719		Hopcroft
367	CalVET Net Tow End	KOD8	5/6/2019 17:53	1:53:31 AM	57.44204	150.1246	719		Hopcroft
368	CTD 65 Start	KOD7	5/6/2019 19:06	3:06:07 AM	57.55736	150.3384	181		Danielson
369	CTD 65 End	KOD7	5/6/2019 19:19	3:19:43 AM	57.55689	150.3377	181		Danielson
370	CalVET Net Tow Start	KOD7	5/6/2019 19:22	3:22:39 AM	57.55713	150.3376	181		Hopcroft
371	CalVET Net Tow End	KOD7	5/6/2019 19:28	3:28:10 AM	57.55753	150.3373	181		Hopcroft
372	CTD 66 Start	KOD6	5/6/2019 20:45	4:45:35 AM	57.6705	150.5412	98		Danielson
373	Fe Fish End	KOD6	5/6/2019 20:50	4:50:53 AM	57.66984	150.5405	98		Aguilar-Islas
374	CTD 66 End	KOD6	5/6/2019 20:56	4:56:06 AM	57.66987	150.5401	98		Danielson
375	CalVET Net Tow Start	KOD6	5/6/2019 20:59	4:59:01 AM	57.66979	150.54	98		Hopcroft
376	CalVET Net Tow End	KOD6	5/6/2019 21:04	5:04:30 AM	57.66981	150.5402	98		Hopcroft
377	Bongo 60 cm Start	KOD6	5/6/2019 21:16	5:16:50 AM	57.67159	150.543	98	overcast	Hopcroft
378	Bongo 60 cm Bottom	KOD6	5/6/2019 21:21	5:21:33 AM	57.67563	150.5495	98		Hopcroft
379	Bongo 60 cm End	KOD6	5/6/2019 21:27	5:27:25 AM	57.67849	150.5549	98		Hopcroft
380	Bongo 60 cm Start	KOD5	5/6/2019 22:31	6:31:10 AM	57.78341	150.7578	86		Hopcroft
381	Bongo 60 cm Bottom	KOD5	5/6/2019 22:33	6:33:42 AM	57.78479	150.7584	86		Hopcroft
382	Bongo 60 cm End	KOD5	5/6/2019 22:41	6:41:03 AM	57.78835	150.7644	86		Hopcroft
383	Bongo 60 cm Start	KOD4	5/6/2019 23:46	7:46:30 AM	57.90068	150.9678	74		Hopcroft
384	Bongo 60 cm Bottom	KOD4	5/6/2019 23:51	7:51:11 AM	57.90037	150.9634	74		Hopcroft
385	Bongo 60 cm End	KOD4	5/6/2019 23:55	7:55:44 AM	57.89896	150.9601	74		Hopcroft
386	Bongo 60 cm Start	KOD3	5/7/2019 0:59	8:59:34 AM	58.01416	151.1755	81		Hopcroft
387	Bongo 60 cm Bottom	KOD3	5/7/2019 1:06	9:06:23 AM	58.01175	151.1673	81		Hopcroft
388	Bongo 60 cm End	KOD3	5/7/2019 1:10	9:10:11 AM	58.01087	151.1644	81		Hopcroft
389	Bongo 60 cm Start	KOD2	5/7/2019 2:14	10:14:24 AM	58.13008	151.377	127		Hopcroft
390	Bongo 60 cm Bottom	KOD2	5/7/2019 2:20	10:20:48 AM	58.13042	151.3681	127		Hopcroft
391	Bongo 60 cm End	KOD2	5/7/2019 2:27	10:27:39 AM	58.13121	151.3603	127		Hopcroft
392	Bongo 60 cm Start	KOD1	5/7/2019 3:31	11:31:55 AM	58.24412	151.5822	71		Hopcroft
393	Bongo 60 cm Bottom	KOD1	5/7/2019 3:35	11:35:44 AM	58.2434	151.578	71		Hopcroft
394	Bongo 60 cm End	KOD1	5/7/2019 3:40	11:40:59 AM	58.24277	151.5727	71		Hopcroft
395	CTD 67 Start	KOD1	5/8/2019 6:06	2:06:48 PM	58.24578	151.5833	70		Danielson
396	CTD 67 End	KOD1	5/8/2019 6:18	2:18:50 PM	58.24276	151.5809	70		Danielson
397	CalVET Net Tow Start	KOD1	5/8/2019 6:21	2:21:53 PM	58.24213	151.5808	70		Hopcroft
398	CalVET Net Tow End	KOD1	5/8/2019 6:25	2:25:29 PM	58.24139	151.5807	70		Hopcroft
399	Fe Fish Start	KOD1	5/8/2019 6:30	2:30:57 PM	58.23777	151.5791	70		Aguilar-Islas
400	CTD 68 Start	KOD2	5/8/2019 7:34	3:34:02 PM	58.12844	151.3833	125		Danielson
401	CTD 68 End	KOD2	5/8/2019 7:46	3:46:51 PM	58.12534	151.3828	125		Danielson
402	CalVET Net Tow Start	KOD2	5/8/2019 7:49	3:49:20 PM	58.12502	151.3826	125		Hopcroft
403	CalVET Net Tow End	KOD2	5/8/2019 7:54	3:54:58 PM	58.12388	151.3818	125		Hopcroft
404	CTD 69 Start	KOD3	5/8/2019 9:00	5:00:18 PM	58.0143	151.1793	75		Danielson
405	CTD 69 End	KOD3	5/8/2019 9:10	5:10:16 PM	58.01099	151.175	75		Danielson
406	CalVET Net Tow Start	KOD3	5/8/2019 9:13	5:13:21 PM	58.00953	151.1737	75		Hopcroft

Event #	Description	Station	Local	GMT	Latitude	Longitude	Depth	Comments	Scientist
407	CalVET Net Tow End	KOD3	5/8/2019 9:16	5:16:52 PM	58.00823	151.1723	75		Hopcroft
408	CTD 70 Start	KOD4	5/8/2019 10:25	6:25:18 PM	57.89874	150.9699	73		Danielson
409	CTD 70 End	KOD4	5/8/2019 10:33	6:33:47 PM	57.89577	150.9697	73		Danielson
410	CalVET Net Tow Start	KOD4	5/8/2019 10:36	6:36:56 PM	57.89457	150.9694	73		Hopcroft
411	CalVET Net Tow End	KOD4	5/8/2019 10:40	6:40:23 PM	57.89331	150.9693	73		Hopcroft
412	CTD 71 Start	KOD5	5/8/2019 11:57	7:57:45 PM	57.78101	150.7559	85	prod	Strom
413	CTD 71 End	KOD5	5/8/2019 12:10	8:10:31 PM	57.77858	150.7579	85		Strom
414	CalVET Net Tow Start	KOD5	5/8/2019 12:13	8:13:36 PM	57.77804	150.7585	85		Hopcroft
415	CalVET Net Tow End	KOD5	5/8/2019 12:17	8:17:28 PM	57.77763	150.7593	85		Hopcroft
416	CalVET Net Tow Start	KOD5	5/8/2019 12:27	8:27:43 PM	57.77565	150.7632	85	genetics	Hopcroft
417	CalVET Net Tow End	KOD5	5/8/2019 12:31	8:31:21 PM	57.77541	150.7641	85		Hopcroft
418	CTD 72 Start	KOD5	5/8/2019 12:47	8:47:04 PM	57.78384	150.7624	85		Danielson
419	CTD 72 End	KOD5	5/8/2019 12:57	8:57:40 PM	57.78355	150.7659	85		Danielson